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A review of the aphid genus *Macrosiphoniella* del Guercio, 1911 (Hemiptera: Aphididae) in the USA with description of a new species

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Abstract
Here we present a review of the 18 species of the Macrosiphini genus *Macrosiphoniella* (Hemiptera: Aphididae) known to occur in the United States of America, representing two subgenera, *Macrosiphoniella* and *Phalangomyzus* Börner, 1939. We report key features for all species including colour in life and pigmentation on slides of apterous and alate viviparous females of all 18 species. Distributional data, host plants, and biological notes of the reviewed species are presented. Apterous, alate and oviparous females of a new native USA species, *Macrosiphoniella sunshine* **sp. nov.**, associated with *Eriophyllum lanatum* (Asteraceae) are described from specimens collected in California, Oregon, and Washington. Keys to apterous and alate viviparous females of the *Macrosiphoniella* in the USA are also provided.

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Keywords: *America, aphids,* Macrosiphini, *new taxa,* SEM

1. Introduction

The aphid genus *Macrosiphoniella* Del Guercio, 1911, with about 159 recognized species, is one of the most speciose within the tribe Macrosiphini (Favret 2020). Most of the known species are present and native in the Palaearctic, and of the 17 species listed from the USA (Hille Ris 1966; Robinson 1987; Foottit et al. 2006;; Skvarla et al. 2017; Blackman & Eastop 2000, 2020) only six species are believed to be native (Robinson 1987).

Representatives of the genus *Macrosiphoniella* are known as medium-sized to big aphids, living on herbaceous plants without host alternation. Apterous viviparous females of this genus are characterized by antennae always longer than body, first segments of tarsi with three setae, dorsum of body with antesiphuncular sclerites and scleroites. Siphunculi have an evident distal zone of reticulation and are often similar in length to the cauda (Heie 1995; Blackman 2010). They feed on various Asteraceae, mostly on *Artemisia, Achillea, Aster, Chrysanthemum* or *Helichrysum* (Holman 2009; Barbagallo & Massimino Cocuzza 2014). Due to similarities in morphology, the genus is treated as related to *Macrosiphum* Passerini, 1860, *Uroleucon* Mordvilko, 1914, *Staticobium* Mordvilko, 1914, and *Obtusicauda* Soliman, 1927 (Robinson 1987; Heie 1995), but recent molecular studies confirmed the closest relationship with *Uroleucon* (Choi *et al.* 2018).

Several accounts have been given for this genus in different parts of the world, mostly in the Palaearctic (Shaposhnikov 1964; Miyazaki 1971; Ivanoskaya 1977; Holman & Szelegiewicz 1974; 1978; Szelegiewicz 1980; Heie 1995; Holman et al. 2006a, 2006b; Blackman 2010). Few papers have been published regarding *Macrosiphoniella* in North America. Hottes and Frison (1931) listed four

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species including the description of *M. tapuskae* from Illinois, USA. Palmer (1952) gave short descriptions of a few species collected in the Rocky Mountain Region, but there was no key for identification of species of this genus until Robinson's (1987) checklist and description of *M. paucisetosa* from Canada.

From 2009 until 2018 specimens of subgenus *Macrosiphoniella* similar to *M. ludovicianae* have been collected from *Eriophyllum lanatum* (Asteraceae) in California, Oregon, and Washington, USA. After careful examination, we recognized an undescribed species of which the description is given in this paper together with a review of the remaining species of the genus so far reported in the USA.

2. Materials and methods

2.1. Materials

The specimens of the new species as well as of other species collected by the first author have been preserved and slide mounted as described on his website, https://aphidtrek.org/?page_id=26. Briefly, puncture the abdomen of each aphid and transfer them to a vial of 10% NaOH (plumber's lye) or KOH prepared using distilled water. Heat in a water bath using a soup warming hot plate (about 38°C) for about 20 minutes. Pour these into a dish and pump out most of the contents of each aphid using a small spatula. Heat aphids in fresh NaOH (or KOH) for another 30–40 minutes. In a dish, finish pumping coloured body contents, then transfer clear aphids to 50% ethanol, let stand without heat, covered, for at least 10 minutes. Transfer to 70% ethanol for 15 minutes at least. Transfer to 95% ethanol for at least 1 hour, up to several hours. Use a microspatula to scoop one or more insects out of the ethanol, then lightly touch an absorbent napkin to remove most of the excess ethanol from the specimen(s) and transfer to unheated clove oil for at least 2 hours. Mount in Canada balsam (thinned as needed with orange oil). Press the cover slip enough so the legs lie flat, but the head and appendages are not deformed. Identifications of the material and confirmation of the material deposited in collections were made according to Blackman and Eastop (2020), Robinson (1987) and Heie (1995). Host plants of collections made by the first author were initially identified using local floras such as Hitchcock and Cronquist (1973). The specimens were examined using light microscope Leica DM 3000 led and photographed by Leica MC 190 HD camera. The measurements were done according to Ilharco and van Harten (1987) and Kanturski et al. (2017) using the Leica LAS system with the LAS Live Measurement pack. Measurements are given in millimetres. Material examined of each species is given in the review of species. References to specimens numbers and depository information of specimens of apterous and alate viviparous females on Figures 1–4 are given in Table S1 (supplementary material). Actual host plant names are given according to The Plant List (2013). The U.S. state and host plants records for each species are gathered from references including Palmer 1952; Robinson 1987; Foottit et al. 2006; Holman 2009; Blackman & Eastop 2020; and from specimens in the NHM, AJ collections.

In the case of some species covered here, the authors did not have access to specimens collected from the USA. For the sake of convenience, we chose to use material from elsewhere that was in our collections or that of the NHM. We considered this adequate for a review paper such as this, given the difficulty in borrowing USA-collected material from the various institutions where such might exist.

The following abbreviations are used:

ANT antennae or their lengths;
ANT I–VI antennal segments I, II, III, IV, V, VI or their lengths (ratios between antennal segments are simply given as e.g. "VI: III")
BASE basal part of last antennal segment or its length;
BD III basal articular diameter of ANT III;
BL body length (from anterior border of the head to the end of cauda);
FEMORA III hind femora length;
HW greatest head width across compound eyes;
HT II second segment of hind tarsus or its length;
LS ANT III length of longest setae of ANT III;
PT processus terminalis of last antennal segment or its length;
SIPH siphunculi length;
TIBIAE III hind tibiae length;
URS ultimate segments of rostrum (IV + V) or their length;
apt. viv. fem. apterous viviparous female;
al. viv. fem. alate viviparous female;
ov. fem. oviparous female.

Depositories of the material examined:
AJ Andrew S. Jensen Aphididae Collection, Lakeview, OR (USA);
DZUS Hemiptera Collection of the Department of Zoology, University of Silesia in Katowice (Poland);
IZISU Institute of Zoology at Ilia State University (Georgia);
NHM Natural History Museum, London (United Kingdom);
USNM National Collection of Aphidomorpha, Beltsville, MD (USA);
ZMPA Zoological Institute, Polish Academy of Sciences, Warsaw (Poland).

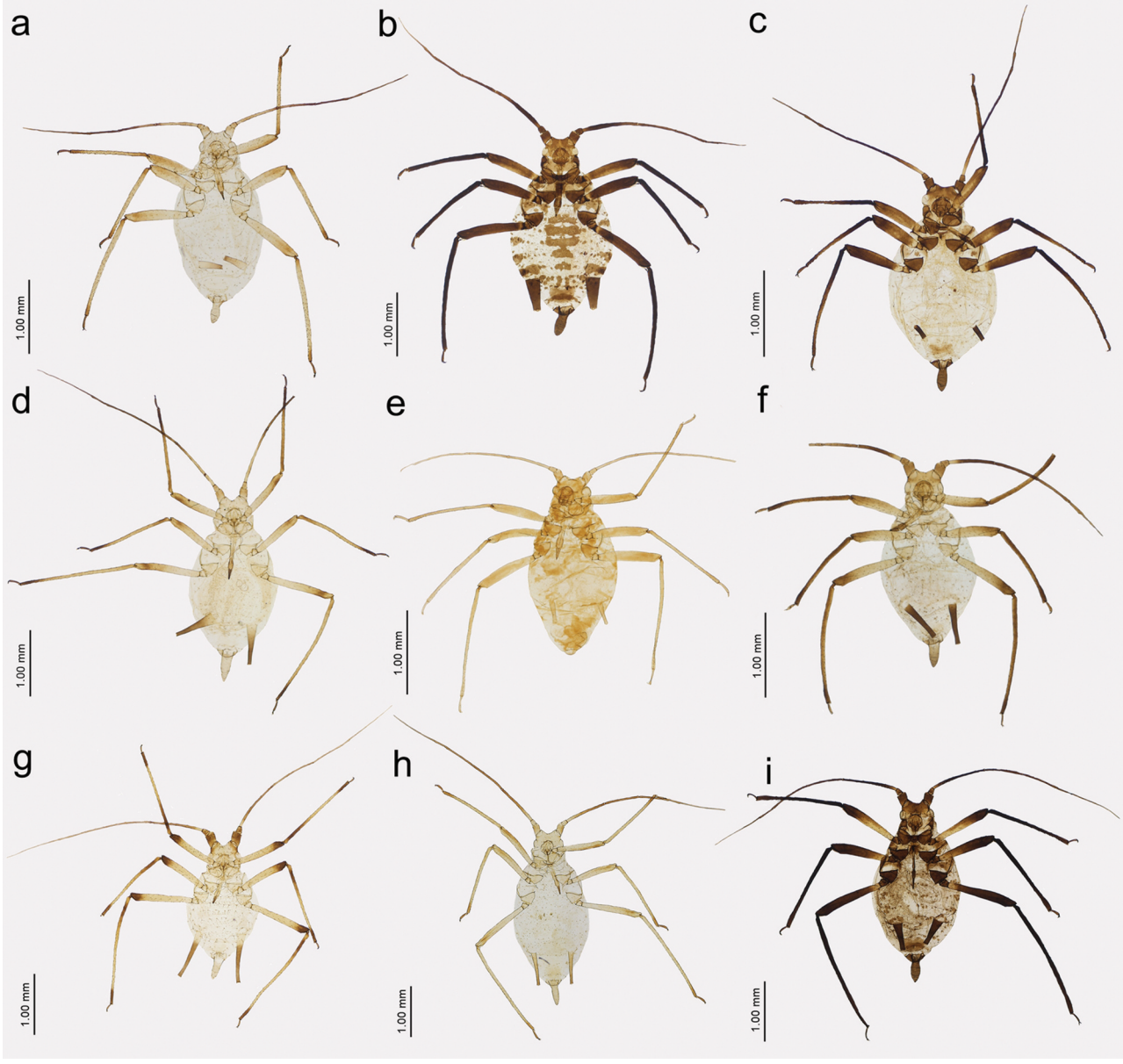

Figure 1. *Macrosiphoniella* of USA – apterous viviparous females: (a) *M. abrotani*, (b) *M. absinthii*, (c) *M. artemisiae*, (d) *M. cinerescens*, (e) *M. frigidicola*, (f) *M. glabra*, (g) *M. leucanthemi*, (h) *M. ludovicianae*, (i) *M. millefolii*.

Type material will be deposited in AJ, DZUS, IZISU and USNM.

2.2. *Scanning electron microscopy*

Specimens for SEM analyses were preserved in 70% ethanol for several days. From ethanol, the specimens were transferred into 6% phosphotungstic acid (PTA) solution in 70% ethanol for 24 hours. Dehydration was provided by ethanol series of 80, 90, 96% and two changes of absolute ethanol for 10 minutes each. Some of the dehydrated specimens were treated with chloroform for 24 h. Dehydrated and cleaned specimens were dried using the Leica EM CPD 300 auto critical point dryer (Leica Microsystems, Vienna, Austria). Dry samples were mounted on aluminium stubs with double-sided adhesive carbon tape and sputter-coated with 30 nm layer of chromium in a Quorum 150 T ES Plus sputter coater (Quorum Technologies Ltd, Laughton, East Sussex, UK). The specimens were imaged by the Hitachi SU8010 field emission scanning electron

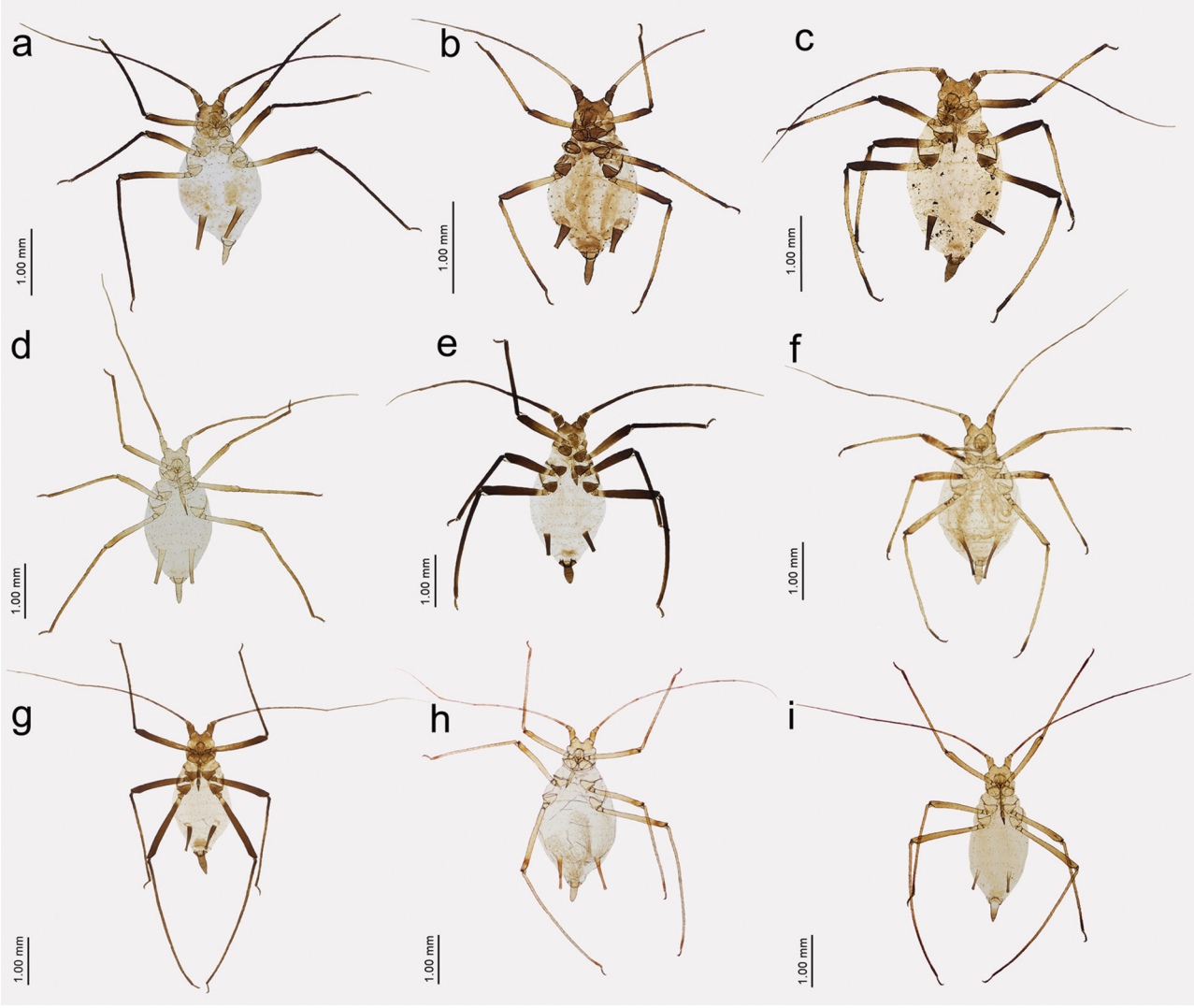

Figure 2. *Macrosiphoniella* of USA – apterous viviparous females: (a) *M. pennsylvanica*, (b) *M. sanborni*, (c) *M. subterranea*, (d) *M. sunshine* **sp. nov.**, (e) *M. tanacetaria*, (f) *M. tapuskae*, (g) *M. antennata*, (h) *M. grandicauda*, (i) *M. oblonga*.

microscope FESEM (Hitachi High-Technologies Corporation, Tokyo, Japan) at 5 and 7 kV accelerating voltage with a secondary electron detector (ESD). Final figure processing was done using Photoscape 3.7 (photoscape.org) and Irfanview 64 (irfanview.com).

3. Results

1. **Checklist of the *Macrosiphoniella* of the USA** (underlined species are believed to be native to North America):

Family Aphididae Latreille, 1802
Tribe Macrosiphini Wilson, 1910
Genus *Macrosiphoniella* Del Guercio, 1911: 331

Subgenus *Macrosiphoniella*, 1911

1. *M.* (*M.*) *abrotani* (Walker, 1852)
2. *M.* (*M.*) *absinthii* (Linnaeus, 1758)
3. *M.* (*M.*) *artemisiae* (Boyer de Fonscolombe, 1841)
4. *M.* (*M.*) *cinerescens* Hille Ris Lambers, 1966
5. *M.* (*M.*) *frigidicola* Gillette & Palmer, 1928
6. *M.* (*M.*) *glabra* (Gillette & Palmer, 1928)
7. *M.* (*M.*) *leucanthemi* (Ferrari, 1872)
8. *M.* (*M.*) *ludovicianae* (Oestlund, 1886)
9. *M.* (*M.*) *millefolii* (De Geer, 1773)
10. *M.* (*M.*) *pennsylvanica* (Pepper, 1950)
11. *M.* (*M.*) *sanborni* (Gillette, 1908)
12. *M.* (*M.*) *subterranea* (Koch, 1855)
13. *M.* (*M.*) *sunshine* **sp. nov.**

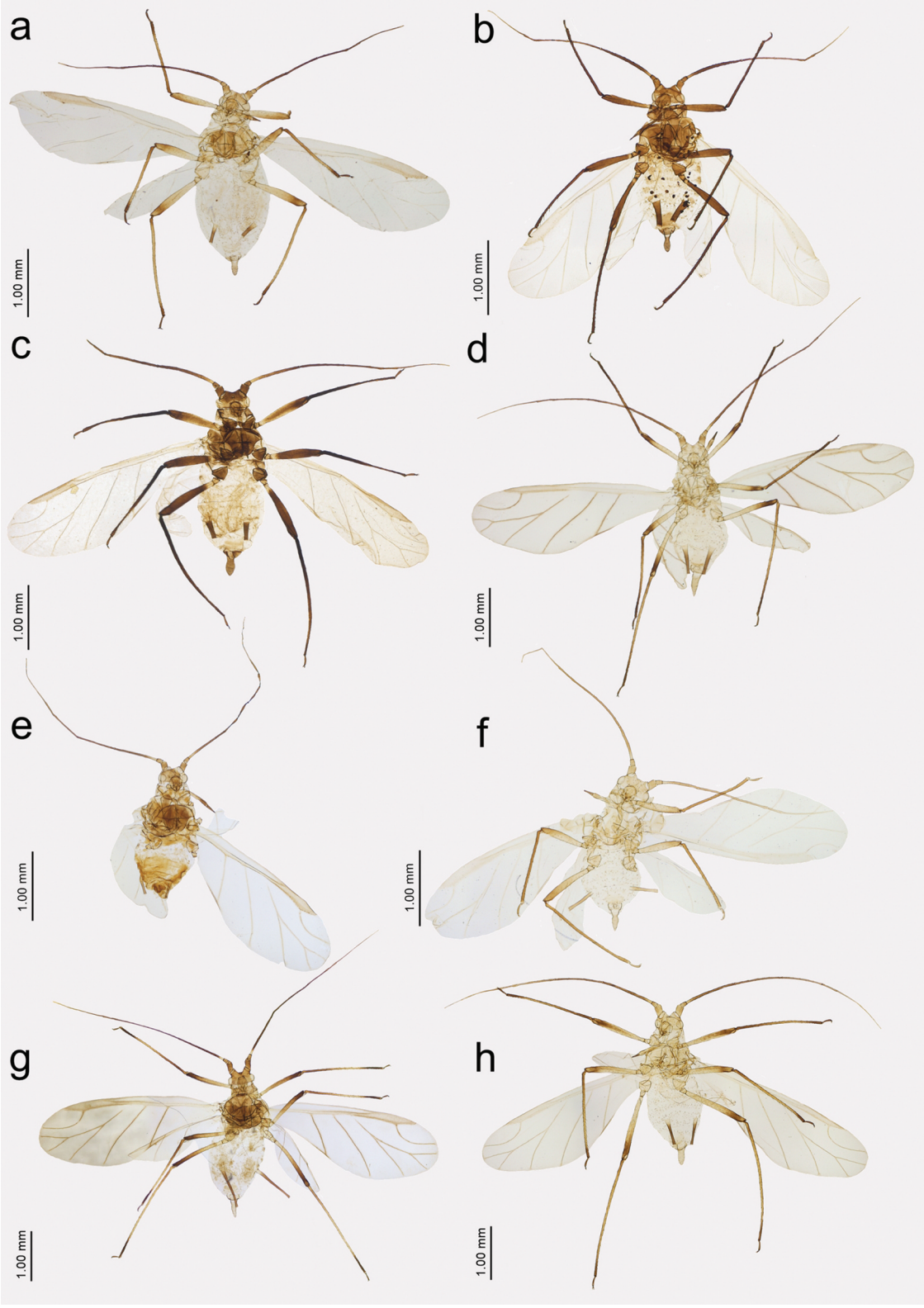

Figure 3. *Macrosiphoniella* of USA – alate viviparous females: (a) *M. abrotani*, (b) *M. absinthii*, (c) *M. artemisisae*, (d) *M. cinerescens*, (e) *M. frigidicola*, (f) *M. glabra*, (g) *M. leucanthemi*, (h) *M. ludovicianae.*

14. *M.* (*M.*) *tanacetaria* (Kaltenbach, 1843)
15. *M.* (*M.*) *tapuskae* (Hottes & Frison, 1931)

Subgenus *Phalangomyzus* Börner 1939

1. *M.* (*P.*) cf. *antennata* Holman & Szelegiewicz, 1978
2. *M.* (*P.*) *grandicauda* Takahashi & Moritsu, 1963
3. *M. (P.) oblonga* (Mordvilko 1901)

1. Comparison to similar genera present in the USA.

As noted above, the genera in North America considered similar to *Macrosiphoniella* are *Macrosiphum, Obtusicauda, Staticobium*, and *Uroleucon*. All these genera share the following characters in most species: head with well-developed antennal tubercles with diverging inner sides, antennae longer than body with ANT III with secondary rhinaria in apterae and relatively long PT, legs relatively long, siphunculi with a subapical zone of polygonal reticulation, and cauda normally elongate-triangular to long and finger-like. Almost all *Macrosiphoniella* species differ from *Macrosiphum* by having accessory setae on the URS longer than the subapical primary setae. An example species that deviates from this norm is *Macrosiphoniella leucanthemi*, which has a URS very much like many *Macrosiphum* species. Other common *Macrosiphoniella* characters, however, can usually be used to separate borderline species from *Macrosiphum*. These include frequent presence of pigmented scleroites on the dorsal side of abdomen and the usual presence of antesiphuncular sclerites in *Macrosiphoniella* (only rarely present in *Macrosiphum*), the cauda of *Macrosiphoniella* usually being about equal in length to the siphunculi, and the usual presence of uniform imbrications on ANT III in *Macrosiphoniella* (ANT III usually smooth beyond extreme base in *Macrosiphum*). That said, the first author sometimes sees specimens from western North America that cannot be identified to species nor assigned easily to either genus.

Macrosiphoniella and *Obtusicauda* share the feature of URS with basal accessory setae longer than subapical primary setae, but *Obtusicauda* can be easily recognized by the presence of setae on the siphunculi in almost all specimens. *Obtusicauda* species normally also have a long cauda that is thick apically, not pointed as in *Macrosiphoniella*, and they feed on shrubby members of *Artemisia*. Other features of these two genera are substantially similar.

Staticobium species resemble *Macrosiphoniella* except for their short and blunt URS with accessory setae similar in length to subapical primary setae. Also, their host plants belong to Plumbaginaceae as opposed to Asteraceae.

Uroleucon species mostly have 5-5-5 tarsal I setae, while *Macrosiphoniella* has 3-3-3 (an occasional tarsus in some species will have 4 setae). There are, however, some species of its subgenus *Lambersius* with 3 setae on tarsal segments I, such as specimens identified by the first author as the following: *Uroleucon (Lambersius) zerogutierrezis* (Smith & Knowlton), *Uroleucon (Lambersius) erigeronense* (Thomas), and *Uroleucon (Lambersius) breviscriptum* (Palmer). All such species can be easily separated from almost all *Macrosiphoniella* by the latter genus having URS with accessory setae longer than subapical primary setae and ANT III with distinct imbrications over all or most of its length compared to smooth beyond extreme base in *Uroleucon*.

3.3. Shared characters of representatives of the genus *Macrosiphoniella* in the USA

Apterous viviparous females. In life mostly green or brown, often powdered with wax. Medium-sized to large, oval or narrow aphids with long appendages. Compound eyes big with triommatidia. Antennal tubercles well-developed. Antennae 6-segmented. ANT III with rounded and various-sized mostly slightly protuberant secondary rhinaria. ANT V with one small, rounded primary rhinarium with ciliated edge. ANT VI with one small, rounded primary rhinarium with ciliated edge and 5 or 6 very small accessory rhinaria, tightly adhering to the primary rhinarium. Rostrum reaching to middle or hind coxae. URS usually stiletto-shaped or elongated, usually with 6 accessory setae. First segment of tarsi with 3-3-3 setae (rarely one or more tarsi with 4 setae). Dorsal side of body with short or medium-sized, thick and slightly capitate setae. Abdomen with often crescent-shaped antesiphuncular sclerites and scleroites which may be fused into bigger sclerites or cross-bars. SIPH tubular or tapering with evident subapical zone of reticulation. Cauda finger- or tongue-shaped, often with a constriction near the base.

Alate viviparous females. Head and thorax intensely sclerotized. Head with big compound eyes,

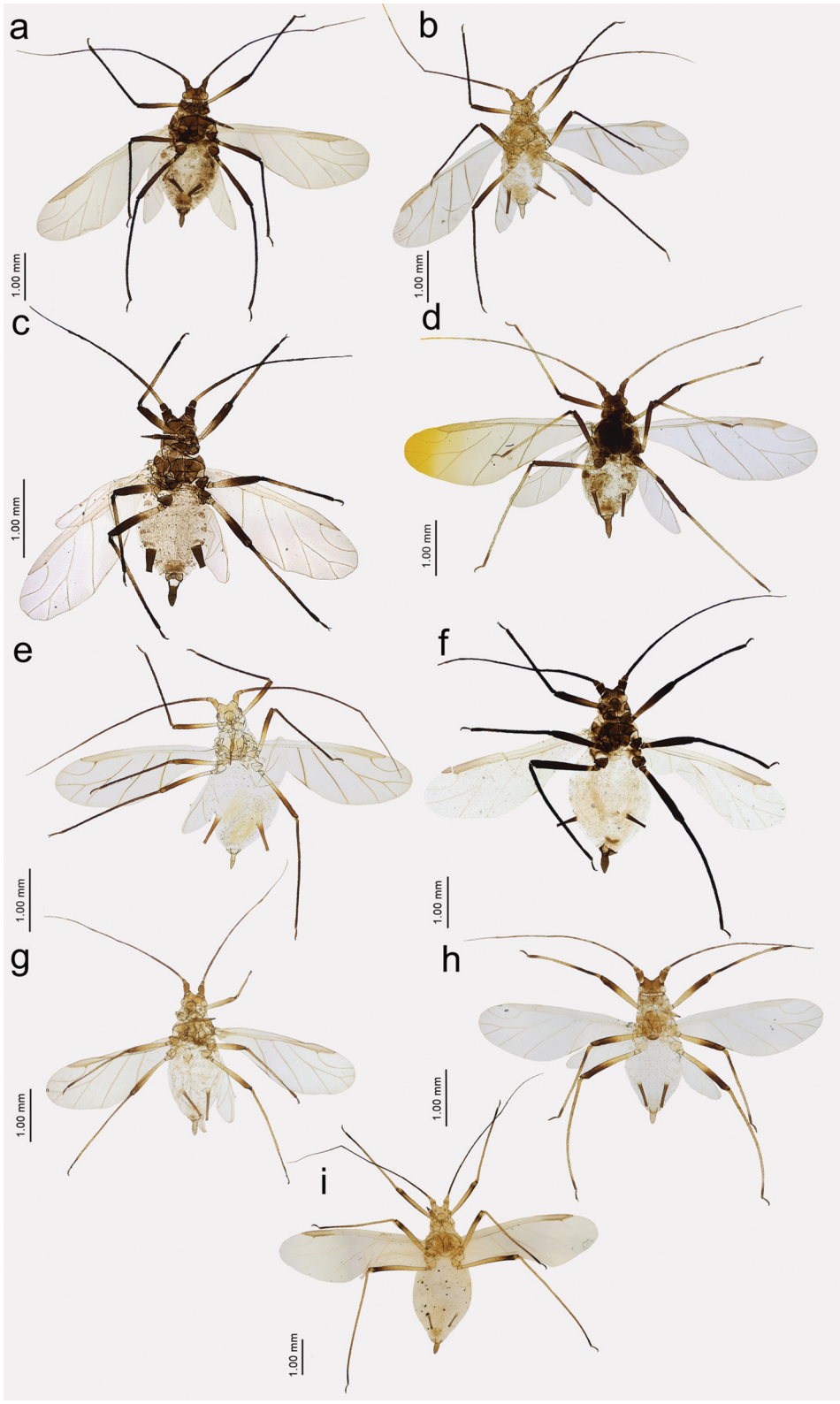

Figure 4. *Macrosiphoniella* of USA – alate viviparous females: (a) *M. millefolii*, (b) *M. pennsylvanica*, (c) *M. sanborni*, (d) *M. subterranea*, (e) *M. sunshine* **sp. nov.**, (f) *M. tanacetaria*, (g) *M. tapuskae*, (h) *M. grandicauda*, (i) *M. oblonga*.

triommatidia, and ocelli. ANT with secondary rhinaria on ANT III. Secondary rhinaria rounded, various-sized, with smooth edge, arranged on the whole length of the segment. ANT V with one small, rounded primary rhinarium with ciliated edge. ANT VI with one small, rounded primary rhinarium with ciliated edge and 5 or 6 very small accessory rhinaria, tightly adhering to the primary rhinarium. Rostrum reaching meso- or metasternum. URS usually stiletto-shaped or elongated with 6 accessory setae. Fore wings hyaline with brown veins. Media twice-branched, RS curved. Pterostigma more or less pigmented. Hind wings with two oblique veins. First segment of tarsi with 3-3-3 setae (rarely one or more tarsi with 4 setae). Body setae short or medium-sized, thick and with slightly capitate apices. Abdomen with antesiphuncular and marginal sclerites. SIPH tubular or tapering. Cauda finger- or tongue-shaped.

3.4. *Review of species*

***Macrosiphoniella* (*Macrosiphoniella*) *abrotani* (Walker, 1852)**

Aphis abrotani Walker, 1852: 1035

Figures 1a and 3a

Colour in life: apterous viviparous females greyish green to dull grass green, slightly wax-powdered. Thorax and abdomen with dark green spinal stripe. ANT and legs usually pale with darker apices of ANT III–V and distal parts of femora and tibiae. Siphunculi light brown with darker apices. Cauda pale. Alate viviparous females similar in colouration with brownish-green head and thorax (Heie 1995).

Pigmentation on slide: apterous viviparous females in general light brown to yellow. Head slightly sclerotized yellow. Antennae light brown with darker apex of ANT III, distal half of ANT IV and whole ANT V–VI. Femora yellow to light brown with darker apical parts. Tibiae yellow, darker basally and apically. Abdomen yellow without sclerotization, siphunculi pale to yellow with darker apices, cauda yellow (Figure 1a). Alate viviparous females with sclerotized head and thorax, yellow to light brown. Antennae uniformly brown with slightly paler basal part of ANT III. Femora yellow to light brown with darker patches or stripes subapically, with extreme apex paler. Tibiae yellow to light brown, darker basally and apically. Siphunculi brown with paler basal parts, cauda yellow, paler than the dark parts of siphunculi (Figure 3a).

Host plants and biology: This species feeds mostly on young stems of *Artemisia abrotanum* and may also be found on other *Artemisia* spp., *Chamomilla* and *Matricaria*. This species is holocyclic with oviparae and alate males in the autumn (Heie 1995; Blackman & Eastop 2020).

Distribution: Illinois – first record in 1929, Iowa, New York, Tennessee.

Material examined: USA, **New York**, Middleport, 3 apt. viv. fem., *Anthemis cotula*, 22.07.1965, leg. M. E. MacGillivray, 010012736 (NHM); 7mls S. E. from Middleport, 2 al. viv. fem., 27.07.1965, 010012735 (NHM); al. viv. fem., 22.07.1965, 010012737 (NHM), 2 al. viv. fem., 010012738 (NHM).

***Macrosiphoniella* (*Macrosiphoniella*) *absinthii* (Linnaeus, 1758)**

Aphis absinthii Linnaeus, 1758: 452

Absinthe aphid

Figures 1b and 3b

Colour in life: Apterous viviparous females generally reddish-brown and partly wax-powdered. Head, thorax, and pleural areas of abdomen grey from the wax powder. Antennae and legs black. Abdomen with black shiny spot in the middle and shiny black at the end. Siphunculi and cauda black. Alate viviparous females brownish or reddish-brown with black head, thorax and appendages (Heie 1995).

Pigmentation on slide: Apterous viviparous females quite sclerotized and in general brown to dark. Head sclerotized, brown, ANT brown, sometimes with darker middle part of ANT III–IV. Thorax sclerotized, brown. Femora brown with slightly paler bases. Tibiae uniformly dark. Abdomen with brown sclerotization, ABD I–III with large spino-pleural cross bars, ABD IV–V with spinal ones, ABD VI–VII with scleroites at setal bases, ABD VIII with a thin crossbar. Marginal and antesiphuncular sclerites present. SIPH and cauda brown to dark (Figure 1b). In alate viviparous females head and thorax sclerotized brown. ANT brown with darker ANT III and sometimes basal half of ANT IV. Femora uniformly brown with paler bases. Tibiae uniformly brown to dark. Abdomen similar to aptera, usually with spino-pleural crossbars on ABD I–III, spinal on ABD IV and scleroites at setal bases on ABD V–VII. Sometimes ABD I only with more or less fused scleroites, ABD II–IV with spinal crossbars, and other segments with scleroites except ABDVIII with narrow crossbar. Marginal and antesiphuncular scleroites evident. SIPH and cauda brown to dark (Figure 3b).

Host plants and biology: Mostly feeds on upper parts on stems of *Artemisia absinthium* and other *Artemisia* species. The species is holocyclic with apterous or alate males (Heie 1995; Blackman & Eastop 2020).

Distribution: California, Florida, Idaho, Illinois, Kansas, New York, Oregon, Washington. *Macrosiphoniella absinthi* is native in Palaearctic and first documented in the USA in 1879.

Material examined: CANADA, New Brunswick, Fredericton, 1 apt. viv. fem., *Artemisia absinthium*, 12.06.1950, leg. P. B. Spicer, 010012973 (NHM); British Columbia, Vancouver, UBC, 1 apt. viv. fem., *Artemisia absinthium*, 30.05.1993, leg. A. Jensen, AJ470 (AJ); USA, **New York**, Lock Port, 4 apt. viv. fem., *Artemisia schmidtiana nana*, 22–27.08.1965, leg. M. E. MacGillivray, 010012945 (NHM), 2 al. viv. fem., 010012960 (NHM); **California**, Alameda Co., Berkeley, 3 apt. viv. fem., 1 al. viv. fem., *A. absinthium*, leg. A. Jensen, AJ7072 (AJ), **Idaho**, Ada Co., Boise, 2 apt. viv. fem., 11.06.2014, AJ7305 (AJ), **Oregon**, Benton Co., Bellfountain, 1 al. viv. fem., *Artemisia* sp., 13.06.1995, AJ471 (AJ), **Washington**, Kittitas Co., Suncadia Resort, 1 ap. viv. fem., *Artemisia* sp., 19.06.2011, AJ5047 (AJ), Okanogan Co., Bonaparte Lake, 1 al. viv. fem., *Artemisia* sp., 01.09.2001, AJ1425 (AJ), 1 al. viv. fem., AJ1426 (AJ), 1 al. viv. fem., AJ1427 (AJ), 1 al. viv. fem., AJ1428 (AJ), 1 al. viv. fem., AJ1429 (AJ), Ferry Co., Long Lake, 2 apt. viv. fem., *Artemisia* sp., 21.07.2001, AJ1478 (AJ), 2 apt. viv. fem., AJ1479 (AJ), 1 apt. viv. fem., AJ1480 (AJ), 2 apt. viv. fem., AJ1481 (AJ), San Juan Co., Orcas Island, 1 apt. viv. fem., 1 al. viv. fem., *A. absinthium*, 23.07.2009, AJ3823 (AJ).

Macrosiphoniella (*Macrosiphoniella*) *artemisiae* (Boyer de Fonscolombe, 1841)

Aphis artemisiae Boyer de Fonscolombe, 1841: 162

Mugwort aphid

Figures 1c and 3c

Colour in life: Body of apterous viviparous females usually green, covered by white wax, so the colour seems to be pale green with darker spinal longitudinal stripe on ABD II–VI. Head brownish-green. Antennae dark with lighter basal parts of ANT III. Fore femora brown with darker distal parts, middle and hind femora dark brown to black. Tibiae dark brown to black. Siphunculi and cauda dark to black. Alate viviparous females very similar in colouration. Head and thorax grey-green, covered by wax powder. Antennae dark or black except grey-green ANT I and II. Legs dark to black with only bases of femora greenish. Abdomen green, covered by wax powder with darker transverse stripes between ABD segments. Siphunculi and cauda dark to black (Heie 1995).

Pigmentation on slide: Head of apterous viviparous females sclerotized, brown. Antennae dark brown with pale basal part of ANT III. Femora brown except fore femora, which are often lighter basally. Tibiae brown to dark with the more or less paler middle section. Abdomen without sclerotization, antesiphuncular sclerites very pale and hardly visible. Siphunculi and cauda brown (Figure 1d). Head and thorax of alate viviparous females sclerotized, brown. Antennae brown with pale basal part of ANT III. Fore femora light brown from the base to about half of their length with darker apical ends, middle and hind femora brown with only very basal parts pale. Tibiae brown with more or less paler middle section. Abdomen pale, without sclerotization, antesiphuncular sclerites hardly visible. Siphunculi and cauda brown (Figure 3d).

Host plants and biology: Macrosiphoniella artemisiae usually lives on *Artemisia vulgaris*, where this species often forms large colonies, especially between inflorescences. The species is holocyclic and oviparae and alate males occur in the autumn (September–October) (Heie 1995; Blackman & Eastop 2020).

Distribution: California, Colorado, Maine, New York, Oregon, Pennsylvania, Washington. First reported from North America in New Brunswick in 1950.

Material examined: CANADA, **Ontario**, Toronto, North York, Laurentidae Park, 3 apt. viv. fem, al. viv. fem., *Artemisia vulgaris*, 29.08.1956, leg. D. Hille Ris Lambers, 010013184 (NHM), **New Brunswick**, Fredericton, 1 apt. viv. fem., *Artemisia* sp., 12.08.2009, leg. A. Jensen, AJ3994 (AJ); GERMANY, Hattersheim, 2 apt. viv. fem., *Artemisia* sp., 27.06.2014, leg. A. Jensen, AJ7358 (AJ), 2 apt. viv. fem., AJ7358 (AJ); POLAND, Skarżysko-Kamienna, 3 apt. viv. fem., *Artemisia* sp., 14.09.1961, leg. H. Szelegiewicz, R2409, 1404 (ZMPA); USA, **Maine**, Cumberland Co., Portland, 2 apt. viv. fem., *A. vulgaris*, 20.07. 2015, leg. A. Jensen, AJ8091 (AJ), **Pennsylvania**, State College, Botany Bldg., 2 apt. viv. fem., *Artemisia* sp., leg. J. O. Pepper, 010013223 (NHM), Maine, Presque Isle, 3 apt. viv. fem., al. viv. fem., *A. vulgaris*, 09.09.1956, leg. Simpson & Hille Ris Lambers, 010013227 (NHM), 4 apt. viv. fem.,

010013186 (NHM), 4 apt. viv. fem., 010013187 (NHM).

Macrosiphoniella (*Macrosiphoniella*) *cinerescens* Hille Ris Lambers, 1966

Hille Ris Lambers, 1966: 587
Figures 1d and 3d

Colour in life: Apterous viviparous females basically bright sea-green, with paired, narrow oval, white-green spots of wax powder which leave a zigzag median line and marginal spots bare. Ventrally grayish white. Siphunculi on distal half dark but not black, basally pale greenish. Cauda pale greenish with dusky apex. Alate viviparous females are very similar in colouration with less wax-powder and green thorax (Hille Ris Lambers, 1966).

Pigmentation on slide: Apterous viviparous females with head slightly sclerotized, yellow to light brown. Antennae brown with yellow to light brown ANT III, darker apically. Femora yellow to light brown with darker stripe near the apex but the very apex pale. Tibiae yellow to light brown with darker apical parts. Abdomen pale to yellow, without sclerotization. Siphunculi brown, paler basally, cauda yellow to light brown but visibly paler than siphunculi (Figure 1e). In alate viviparous females head and thorax sclerotized, yellow to light brown. Antennae uniformly brown with pale basal part of ANT III. Femora yellow, brown distally. Tibiae yellow to light brown, darker distally. Abdomen pale to yellow without visible sclerotization. Siphunculi brown, yellow to pale basally. Cauda pale to yellow, visibly paler than siphunculi (Figure 3e).

Host plants and biology: The species has been described from *Achillea millefolium* on which it feeds in small colonies on lower leaves and turns their tips brown. Most probably a holocyclic species but the sexual morphs are still unknown.

Distribution. : California, Colorado, Idaho, Oregon, Washington.

Materials examined. : Holotype. USA, **California**, 4 mi E. of Stinson Beach, 1 apt. viv. fem., *Achillea californica*, 02.03.1964, leg. D. Hiller Ris Lambers, 010014584 (NHM), Paratypes. al. viv. fem., the same data and number as holotype, 2 apt. viv. fem., 08.03.1964, 010014583 (NHM), al. viv. fem., 02.03.1964, 010014582 (NHM); Other material: USA, California, Pass across cascades to Burns, 2 apt. viv. fem., 1 al. viv. fem., 22.06.1980, leg. Hille Ris Lambers, 010014578 (NHM), **Colorado**, Monument, 1 apt. viv. fem., *A. millefolium*, 13.09.1956, leg. Hottes & Hille Ris Lambers, 010014576 (NHM), 1 apt. viv. fem., 010014577 (NHM); **Oregon**, Lake Co., Bullard Canyon outside Lakeview, apt. viv. fem., *Achillea millefolium*, 09.06.2016, leg. A. Jensen, AJ8474 (AJ), Wallowa Co., Umatilla N.F. Rd. 62, 1 apt. viv. fem., *Achillea* sp. 17.07.2010, AJ4368 (AJ); Idaho, Shoshone Co., Shefoot Mt., 1 apt. viv. fem., *Achillea* sp., 03.09.2011, AJ5288 (AJ); **Washington**, Kittitas Co., Colockum Pass Rd., 2 apt. viv. fem., *Achillea* sp., AJ4297 (AJ).

Macrosiphoniella (*Macrosiphoniella*) *frigidicola* Gillette & Palmer, 1928

Gillette & Palmer 1928: 3.
Figures 1e and 3e

Colour in life: Apterous viviparous females in general bluish-green covered by wax powder, head brownish. Antennae dark with pale basal part of ANT III. Legs yellow to light brown, siphunculi dusky, pale basally. Alate viviparous females with head and thorax dusky, antennae dark with pale basal part of ANT III. Tibiae dark brown to blackish, tibiae yellowish to brown. Abdomen bluish-green, siphunculi dark with paler bases, cauda dark.

Pigmentation on slide: Apterous viviparous females in general yellow to light brown. Head sclerotized yellow. Antennae yellow with slightly paler basal part of ANT III. Legs yellow with slightly darker distal parts of femora and yellow to light brown tibiae. Abdomen pale to yellow, without visible sclerotization. Siphunculi uniformly pale to light brown. Cauda pale to yellow (Figure 1f). Alate viviparous females with head and thorax sclerotized, light brown to brown, antennae brown with pale basal part of ANT III. Abdomen pale to yellow with hardly visible sclerotization. Siphunculi uniformly pale to yellow, cauda yellow (Figure 3f).

Host plants and biology: This species is common *Artemisia frigida* and *A. tridentata*. Palmer (1952) noted also *Kraschenninnikovia ceratoides* (= *Eurotia lanata*) but according to Blackman and Eastop (2020) records from this plant are probably of alate vagrants. Oviparae and apterous males occur in

October. According to Hottes and Frison (1931), this species could be difficult to locate on the host plant due to its protective colour.

Distribution: Colorado, Idaho, Illinois, Kentucky, Montana, New York, North Dakota, Pennsylvania, Utah.

Material examined: Paratypes. USA, **Colorado**, Poudre Canyon, apt. viv. fem., *Artemisia* sp., 10.05.1917, leg. L. C. Bragg, 010013303 (NHM), apt. viv. fem., 010013429 (NHM); Other material: USA, **Colorado**, Pingree Park, 1 apt. viv. fem., *A. frigida*, leg. G. F. K & Maxon, BM 1954–703 (NHM); **North Dakota**, Slope Co., Little Missouri N. G., Burning Coal Vein, 2 apt. viv. fem., al. viv. fem., *Artemisia frigida*, 29.05.2017, leg. A. Jensen, AJ9198 (AJ); **Montana**, Acton, al. viv. fem., *A. frigida*, 01.08.1942, leg. G. F. Knowlton, 010013304 (NHM).

Macrosiphoniella (*Macrosiphoniella*) *glabra* (Gillette & Palmer, 1928)

Macrosiphum glabrum Gillette & Palmer, 1928: 3

Figures 1f and 3f

Colour in life: Apterous viviparous females are green to dark green, shiny, without wax powder. Antennae dark brown to black with slightly lighter basal part of ANT III. Femora light green with dark distal parts, tibiae dark. Siphunculi dark brown to black, greenish basally. Cauda greenish with slightly dusky apical end. Alate viviparous females very similar in colouration but with head and thorax yellowish-brown.

Pigmentation on slide: Apterous viviparous females in general yellow to pale brown. Head sclerotized light brown, darker laterally between eyes and antennal tubercles. Antennae brown with slightly lighter ANT IV and V and pale basal part of ANT III. Femora yellowish or pale brown, brown distally. Tibiae brown, sometimes with slightly paler middle area. Abdomen with hardly visible, pale antesiphuncular sclerites. Siphunculi brown to dark, sometimes paler basally. Cauda yellowish to pale brown, lighter than siphunculi (Figure 1g). Alate viviparous females with head and thorax sclerotized yellow to pale brown. Antennae pale brown with lighter basal part of ANT III. Femora yellowish to pale yellow with slightly darker distal parts. Tibiae light brown. Abdomen without visible sclerotization. Siphunculi yellow to pale brown with paler basal parts. Cauda pale (Figure 3g).

Host plants and biology: This species is associated with *Artemisia dracunculus* on which it can be found on leaves and flower heads. There is also a record from *Chrysothamnus viscidiflorus*. Oviparae and apterous males occur in late September and October (Palmer 1952).

Distribution: Arizona, Colorado, New Mexico, Oregon, Utah, Washington.

Material examined: Metatype. USA, **Colorado**, Fort Collins, apt. viv. fem., *Artemisia aromatica* (*dracunculoides*), 17.05.1915, leg. L. C. Bragg, 0100492 (NHM). Other material: USA, **Colorado**, Grand Mesa, 5 apt. viv. fem., *Artemisia* sp., 15.09.1956, leg. Hottes & Hille Ris Lambers, 010013422 (NHM), 2 apt. viv. fem., *Artemisia* sp., 010013488 (NHM), 1 apt. viv. fem., 010013417 (NHM), 2 apt. viv. fem., 14.09.1956, 010013418 (NHM); **Washington**, Franklin Co., Sulfur Lake, 3 apt. viv. fem., al. viv. fem., *A. dracunculus*, 11.05.2008, leg. A. Jensen, AJ3001 (AJ), 3 apt. viv. fem., AJ3000 (AJ); Grant Co., Moses Lake, 3 apt. viv. fem., 13.05.2009, AJ3649 (AJ), McConihe Flats, 2 apt. viv. fem., AJ3271 (AJ), Sheep Canyon, 3 apt. viv. fem., 12.06.2009, AJ3891 (AJ), Lake Lenore, 3 apt. viv. fem., AJ4037 (AJ), Lincoln Co., Coffee Pot Lake, 2 apt. viv. fem., 04.08.2009, AJ3846 (AJ), Lincoln, 3 apt. viv. fem., *Artemisia* sp., 21.06.2008, AJ3337 (AJ), 3 apt. viv. fem., AJ3338 (AJ), 3 apt. viv. fem., AJ3339 (AJ); **New Mexico**, Sandoval Co., 4 apt. viv. fem., *Artemisia* sp., 24.09.2010, leg. A. Jensen, AJ4651 (AJ), Bernalillo Co., Hills above ABQ, 1 apt., viv. fem., AJ6036 (AJ), Albuquerque foothills, 3 apt. viv. fem., 17.09.2010, AJ4597 (AJ), 2 apt. viv. fem., AJ4598 (AJ), Socorro Co., Mine Shaft nr. The Box, 2 apt. viv. fem., 24.09.2014, AJ7783 (AJ), Rio Arriba Co., Carson N.F., 1 apt. viv. fem., 1 al. viv. fem., 22.09.2010, AJ4587 (AJ), Lincoln Co., Nogal Peak, 1 apt. viv. fem., *A. dracunculus*, 25.09.2014, AJ7800 (AJ); **Utah**, Garfield Co., Devil's Garden, 4 apt. viv. fem., 09.05.2012, AJ5533 (AJ), San Juan County, Hatch Wash, N of Monticello, 3 apt. viv. fem., AJ6006 (AJ); Arizona, Coconino Co., S-P Crater, 1 ov. fem., 26.09.2013, AJ6928 (AJ); **Oregon**, Wasco Co., I-84 at m.p. 93, 3 apt. viv. fem., 04.06.2004, AJ1848 (AJ), Umatilla Co., McNary Dam, 4 apt. viv. fem., 30.06.2009, AJ3768 (AJ).

Macrosiphoniella (*Macrosiphoniella*) *leucanthemi* (Ferrari, 1872)

Siphonophora leucanthemi Ferrari, 1872: 214

Figures 1g and 3g

Colour in life: Apterous viviparous females yellowish to and green with dark green or reddish-

brown band between the siphunculi. Antennae brown. Legs yellowish with dark distal ends of femora, proximal and distal parts of tibiae. Alate viviparous females with similar colouration with brownish head and thorax and brown bordered wing veins.

Pigmentation on slide: Body of apterous viviparous females in general yellowish-brown. Head sclerotized yellow, darker laterally between compound eyes and ANT tubercles. Antennae brown with paler basal part of ANT III. Femora yellow, dark apically. Tibiae yellow, dark basally and apically, but the extreme apex usually paler. Abdomen with hardly visible, almost unpigmented antesiphuncular sclerites. Siphunculi brown, pale basally. Cauda pale (Figure 1h). Alate viviparous females with head and thorax sclerotized, brown. Antennae brown with paler basal part of ANT III. Femora brown with lighter basal and dark apical ends. Tibiae yellow, brown to dark basally and apically. Abdomen without visible sclerotization. Siphunculi brown, paler basally. Cauda pale (Figure 3h).

Host plants and biology: This aphid lives on *Leucanthemum vulgare* (= *Chrysanthemum leucanthemum*) on which it feeds on undersides of basal leaves or flower stems.

Distribution: Maryland, Oregon, Pennsylvania – first USA record in 1948.

Material examined: USA, **Pennsylvania**, State College, 2 apt. viv. fem., al. viv. fem., *Chrysanthemum leucanthemum*, 30.09.1949, leg. J. O. Pepper, 010013583 (NHM), 3 apt. viv. fem., 010013631 (NHM), 4 apt. viv. fem., 21.07.1962, 010013523 (NHM); **Oregon**, Corvallis, 1 apt. viv. fem., 1 al. viv. fem., *Ch. leucanthemum*, 10.06.1980, leg. D. Hille Ris Lambers, 010013632 (NHM), 2 apt. viv. fem., 010013582 (NHM), 1 apt. viv. fem., 1 al. viv. fem., 010013622 (NHM), 1 apt. viv. fem., 1 al. viv. fem., 010013633 (NHM); Linn Co., H. J. Andrews Forest, 1 al. viv. fem., *Chrysanthemum leucanthemum*, 19.06.1991, leg. A. Jensen, AJ472 (AJ), 1 apt. viv. fem., AJ473 (AJ).

***Macrosiphoniella* (*Macrosiphoniella*) *ludovicianae* (Oestlund, 1886)**

Siphonophora ludovicianae Oestlund, 1886: 23
Figure 1g, 3h, 5b, 12a, c, e, g

Colour in life: Apterous viviparous females slightly wax powered, head pale green, antennae dark brown to black with pale basal part of ANT III, thorax green with sometimes darker marginal parts of pronotum. Femora greenish or yellowish with dark distal parts (very apex paler), tibiae dark brown to black. Abdomen matt green (slate yellowish-green or pale grape-green), siphunculi black, greenish basally. Cauda greenish, sometimes slightly darker apically (Figure 5b). Alate viviparous females similar in colouration to the apterous forms with head and thorax dusky-green.

Pigmentation on slide: Apterous viviparous females in general yellowish to pale brown. Head slightly sclerotized yellow, antennae brown with paler basal part of ANT III. Femora pale to yellowish with light brown distal parts (more often on the dorsal side). Tibiae yellow, blotchy brown basally, brown apically. Abdomen pale without visible sclerotization. Siphunculi yellow to brown, slightly darker distally, pale basally. Cauda yellowish, paler than SIPH (Figure 1i). Alate viviparous females with head and thorax sclerotized, yellow to light brown. Antennae brown with ANT III pale basally. Femora yellow to light brown with darker distal ends, sometimes blotchy brown most of length. Tibiae brown with middle sometimes paler. Abdomen pale without visible sclerotization. Siphunculi brown, pale basally. Cauda pale as the pale bases of SIPH (Figure 4a).

Host plants and biology: This species is commonly associated with *Artemisia ludoviciana* and other species from this genus: *A. dracunculus, A. suksdorfii, A. vulgaris*. The record from *Eriophyllum lanatum* was likely an alate vagrant. Fundatrices of this species occur quite early in the middle of March and the oviparae and alate males occur in October (Palmer 1952; Blackman & Eastop 2020).

Distribution: Arizona, California, Colorado, Idaho, Illinois, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Utah, Washington, Wyoming.

Material examined: CANADA, **British Columbia**, Shorts Creek Canyon nr. Kelo, 2 apt. viv. fem., 2 al. viv. fem., *Artemisia* sp., 10.07.2011, AJ 5169 (AJ); USA, **New Mexico**, Lincoln Co., Nogal Peak, 2 apt. viv. fem., *Artemisia ludoviciana*, 25.09.2014, leg. A. Jensen, AJ7795 (AJ), Cibola Co., La Ventanna Arch, 2 apt. viv. fem., *Artemisia* sp., 19.09.2010, AJ4654 (AJ), Malpais Lava Field, 1 ♀, *Artemisia* sp., 24.09.2014, AJ7821 (AJ), San

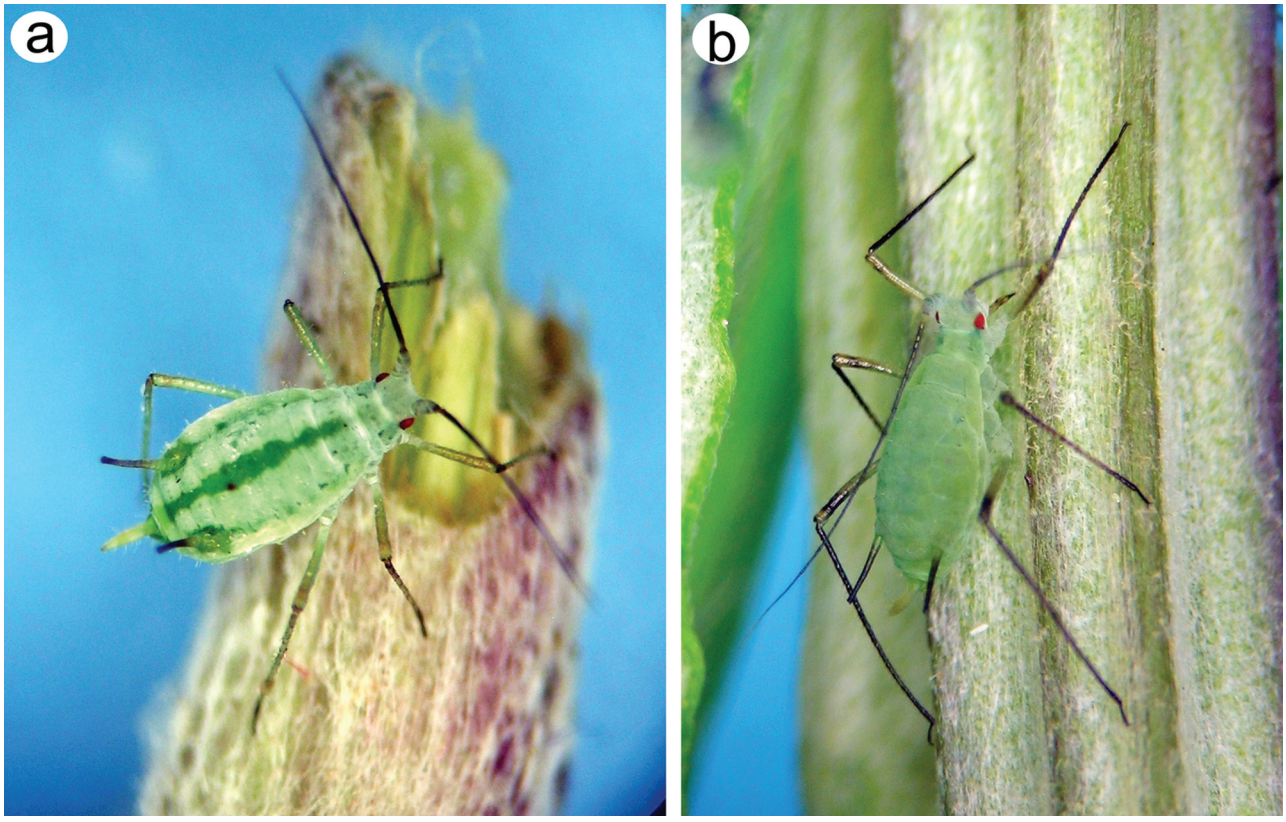

Figure 5. Colouration differences of alive apterous viviparous females of (a) *Macrosiphoniella sunshine* **sp. nov**. and (b) *M. ludovicianae.*

Miguel Co., 20 Mi. N. Pecos, 3 viv. fem., 06.07.2004, AJ1946 (AJ); **Oregon**, Bullard Canyon outside Lakeview, fundatrix, apt. viv. fem., *Artemisia* sp., 02.05.2016, leg. A. Jensen, AJ8316 (AJ), Umatilla Co., Hermiston, 1 apt. viv. fem., *Artemisia* sp., 14.05.1992, AJ474 (AJ), Linn Co., Tombstone Pass, 1 apt. viv. fem., 1 al. viv. fem., 20.08.1991 AJ476 (AJ), near House Rock Campground, 1 al., viv. fem., AJ475 (AJ), Wallowa Co., Hells Canyon, 2 al. viv. fem., 02.08.2008, AJ3224 (AJ), 1 al. viv. fem., AJ3225 (AJ), Umatilla Co., 10 Mi. N. Dale, 2 apt. viv. fem., *Artemisia* sp., 30.06.2004, AJ2150 (AJ), 2 apt. viv. fem., AJ2151 (AJ), McNary Dam, 1 fundatrix, 09.04.2013, AJ6251 (AJ), Josephine Co, Applegate River nr. Murphy, 2 apt. viv. fem., 1 al. viv. fem., *Artemisia* sp., 28.05.2011, AJ4882 (AJ); **California**, Modoc Co., Modoc N. F., Warners Summit Trail, 2 apt. viv. fem., 23.07.2016, AJ8714 (AJ); Berkeley, 3 apt. viv. fem., *A. douglasiana*, 10.11.1963, leg. D. Hille Ris Lambers, 010013639 (NHM), 2 apt. viv. fem., 1 al. viv. fem., 010013643 (NHM), Lake Berryessa, 1 apt. viv. fem., 1 al., viv. fem., *A. douglasiana*, 17.03.1964, leg. D. Hille Ris Lambers, 010013684, 2 apt. viv. fem., 010013638 (NHM); **Idaho**, Owyhee Co., War Eagle Mt., apt. viv. fem., al. viv. fem., *A. ludoviciana*, 06.09.2015, AJ8172 (AJ), Antelope Ridge Rd., 1 apt. viv. fem., *Artemisia* sp., 09.10.2011, AJ5374 (AJ), Reynolds Creek Road, 1 apt. viv. fem., 08.10.2011, AJ5189 (AJ), Gem Co., Squaw Butte, 2 males, 2 ov. fem., *Artemisia* sp., AJ5396 (AJ), Pittsburg Landing Co., Hells Can., 1 apt. viv. fem., 1 al. viv. fem., *Artemisia* sp., 30.05.2011, AJ4765 (AJ), Jerome Co., Snake R. at Murtaugh, 3 ♀, *Artemisia* sp., 19.10.2012, AJ6188 (AJ); **Utah**, Garfield Co., Hell's Backbone, 2 al. viv. fem., *Artemisia* sp., 12.05.2012, AJ5490 (AJ), Dog Valley Rd., 2 apt. viv. fem., 09.05.2012, AJ5544 (AJ), Bear Canyon near Nebo, 3 apt. viv. fem., 1 al. viv. fem., 02.08.1962, leg. G. F. Knowlton, 010013685 (NHM); **Colorado**, Carson Hole, 4 al. viv. fem., *Artemisia* sp., 22.06.1952, leg. F. C. Hottes, 010013679 (NHM), Whitewater, 2 apt. viv. fem., 2 al. viv. fem., *A. ludoviciana*, 23.08.1952, leg. F. C. Hottes, 010013642 (NHM); **Washington**, Yakima Co, Yakima, 1 al. viv. fem., *Artemisia* sp., 02.06.2014, leg. A. Jensen, AJ7314 (AJ), Lincoln Co., Keller Ferry Hill, 2 apt. viv. fem., 11.07.2010, AJ3643 (AJ), Okanogan Co., Harts Pass, 1 fundatrix,

11.07.2010, AJ4337 (AJ), 1 apt. viv. fem., AJ4338 (AJ), near Harts Pass, 1 al. viv. fem., 10.07.2013, AJ6570 (AJ), Franklin Co., Palouse Falls, 1 apt. viv. fem., 15.05.2004, AJ1789 (AJ), 2 apt. viv. fem., 2 al. viv. fem., AJ1790 (AJ), Grant Co., Sheep Canyon, 3 apt. viv. fem., 12.06.2009, AJ3740 (AJ), Kittitas Co., Colockum Creek Headwaters, 1 fundatrix, 3 apt. viv. fem., 1 al. viv. fem., 02.07.2011, AJ4984 (AJ), Whitman Co., Towell Falls, 3 apt. viv. fem., 11.06.2011., AJ4855 (AJ).

Macrosiphoniella (*Macrosiphoniella*) *millefolii* (De Geer, 1773)

Aphis millefolii De Geer, 1773: 60

Yarrow aphid

Figures 3i and 4a

Colour in life: Apterous viviparous females are yellowish-green to green and wax powered laterally with a shiny spinal area. Head and pronotum brownish-green or brownish. Antennae dark brown to black with slightly paler basal part of ANT III. Remainder of thorax brownish-green. Fore femora yellowish or light brown with dark distal ends, middle and hind femora dark brown to black with only base paler. Tibiae dark brown to black. Dorsal side of thorax and abdomen with evident dark brown to black sclerites and scleroites in spinal, pleural and marginal area, antesiphuncular sclerites clearly visible. Siphunculi and cauda uniformly dark brown to black. Alate viviparous females similar in colouration, slightly wax powdered, with head, antennae, and thorax dark brown to black. Legs black except base of fore femora, which are brown. Abdomen green or yellowish-green with clearly visible brown antesiphuncular and marginal sclerites and black SIPH and cauda.

Pigmentation on slide: Apterous viviparous females in general brown to black. Head strongly sclerotized brown. Antennae dark brown with slightly paler basal part of ANT III. Fore femora brown with yellow proximal and dark brown distal parts, middle and hind femora dark brown to black, light brown at extreme base. Tibiae and tarsi black. Abdomen with brown scleroites at setal bases, antesiphuncular and marginal sclerites, uniformly dark brown SIPH and cauda (which can be a little bit paler than SIPH) (Figure 2a). Alate viviparous females with head and thorax sclerotized, dark brown. Antennae dark brown with paler basal part of ANT III and PT. Legs dark brown to black except proximal half of fore and extreme bases of middle and hind femora which are brown or yellow. Abdomen with brown scleroites at setal bases, antesiphuncular and marginal sclerites, uniformly dark brown SIPH and brown cauda (sometimes slightly paler than SIPH) (Figure 4b).

Host plants and biology: The most common host plant for this species is *Achillea millefolium* on which the colonies can be found between the inflorescences (which are concolourous with the aphids). It could be also collected from other *Achillea* species as well as on *Leucanthemum*, *Tanacetum*, and *Tripleurospermum* (Heie 1995; Blackman & Eastop 2020).

Distribution: Connecticut – first USA record in 1938, Maine, Massachusetts, New Hampshire, New Jersey, New York, Oregon, North Carolina, Pennsylvania, Tennessee, Washington.

Material examined: CANADA, **New Brunswick**, Fredericton, 4 apt. viv. fem., *Achillea* sp., 12.08.2009, leg. A. Jensen, AJ3964 (AJ); **Quebec**, Hwy 381, about 40 km north, 2 apt. viv. fem., 1 al. viv. fem., *A. millefolium*, 06.08.2013, AJ6695 (AJ), 2 apt. viv. fem., 2 al. viv. fem., AJ6696 (AJ); USA, **Maine**, Oxford Co., Wild River S. of Gillead, 3 apt. viv. fem., *Achillea* sp., 25.07.2015, AJ8056 (AJ); **New York**, North Lousing, 3 apt. viv. fem., *Achillea millefolium*, 07.07.1965, leg. M. E. MacGillivray, 010013917 (NHM), Verga, 2 al. viv. fem., 29.07.1965, *A. millefolium*, leg. M. E. MacGillivray, 010013919 (NHM), 4 apt. viv. fem., 29.07.1065, 010013980 (NHM); **Oregon**, Tillamook Co, 7 mi E. Tillamook Hwy 6, 2 apt. viv. fem., 22.07.1966, leg. D. Calvert, 010014061 (NHM), 2 apt. viv. fem., 010014054 (NHM), Lincoln Co., Waldport, 1 al. viv. fem., *Achillea* sp., 23.07.1991, leg. A. Jensen, AJ477 (AJ), 1 apt. viv. fem., AJ478 (AJ), Benton Co., Corvallis, 3 apt. viv. fem., 18.08.2010, AJ4708 (AJ); **Washington**, Skagit Co., Mount Vernon, 3 apt. viv. fem., 3 al. viv. fem., *A. millefolium*, 11.07.2008, AJ3218 (AJ), 3 apt. viv. fem., 3 al. viv. fem., AJ3219 (AJ).

Macrosiphoniella (*Macrosiphoniella*) *pennsylvanica* (Pepper, 1950)

Macrosiphum pennsylvanicum Pepper, 1950: 3

Figures 2a and 4b.

Colour in life: Apterous viviparous females in general green with two longitudinal stripes of wax powder on thorax and abdomen. Head slightly darker than thorax. Antennae black with slightly paler basal part of ANT III. Legs black except the basal part of femora which are brown. Abdomen green with black

SIPH and dusky cauda. Alate viviparous females very similar in colouration with the longitudinal wax powder stripes only on the abdomen and lighter basal parts of femora. Cauda pale to dusky.

Pigmentation on slide: Apterous viviparous females with head sclerotized, brown and dark brown ANT with paler basal part of ANT III and PT. Legs dark brown to black (especially tibiae), femora yellow to pale on basal half. Abdomen pale with hardly visible almost colourless scleroites at setal bases, brown SIPH with slightly paler basal parts and yellow cauda, paler than SIPH (Figure 2b). Alate viviparous females with head ant thorax sclerotized, light brown to brown and brown ANT with paler basal part of ANT III and PT. Legs dark brown except yellow to light brown basal parts of femora. Abdomen with hardly-visible sclerotization, brown SIPH with paler basal parts and yellow to pale cauda (Figure 4c).

Host plants and biology: The species is associated with *Achillea millefolium* and is holocyclic with oviparae and alate males in October (Pepper 1950).

Distribution: Arizona, California, North Carolina, Pennsylvania, Tennessee.

Material examined: Paratypes. USA, **Pennsylvania**, Chearfield Co., Quarryville, 1 apt. viv. fem., 2 al. viv. fem., *Achillea millefolium*, 16.06.1944, leg. J. O. Pepper, 010015215 (NHM), 2 al. viv. fem., 010015214 (NHM); Other material: USA. **Arizona**, Gardner Canyon Aquatic sample 15, 1 al. viv. fem., leg. A. Jensen, AJ480 (AJ); **Pennsylvania**, Parker Dam, 3 apt. viv. fem., 17.09.1955, 010015207 (NHM), Philipsburg, 2 al. viv. fem., 11.08.1952, leg. J. O. Pepper, 010015206 (NHM).

Macrosiphoniella (*Macrosiphoniella*) *sanborni* (Gillette, 1908)

Macrosiphum sanborni, Gillette, 1908: 65

Chrysanthemum aphid

Figures 2b and 4c

Colour in life: Apterous viviparous females shiny from dark reddish-brown to almost black, without wax powder. Antennae brown with almost whole ANT III paler (except the distal end) and paler ANT VI. Femora yellow basally, dark on distal half. Tibiae yellow, dark basally and apically. Abdomen shiny with uniformly black SIPH and cauda. Alate viviparous females very similar in colouration, shiny dark reddish-brown to black with only basal parts of ANT III, proximal parts of femora and middle sections of tibiae yellow.

Pigmentation on slide: Head of apterous viviparous females brown. Antennae brown with base of ANT III yellow, darkening toward distal end. Femora yellow basally, darkening to dark brown apically. Tibiae yellow to light brown with dark brown proximal and distal ends. Abdomen with small brown scleroites at setal bases, large, brown antesiphuncular sclerites, uniformly dark brown SIPH and brown cauda (sometimes slightly paler than SIPH) (Figure 2c). Alate viviparous females with sclerotized head and thorax brown to dark brown, dark brown ANT with yellow basal part of ANT III. Femora with up to basal half yellow, tibiae yellow to light brown at least on basal $^1/_3$ of their length with dark brown proximal and distal ends. Abdomen with brown scleroites at setal bases, antesiphuncular and marginal sclerites, uniformly dark brown SIPH and cauda (Figure 4d).

Host plants and biology: Macrosiphoniella sanborni is commonly found on undersides of leaves and tender stems of different species of *Chrysanthemum*, especially in greenhouses where it is treated as a serious *Chrysanthemum* pest and virus vector (e.g. vein mottle and virus B). It is an anholocyclic species (Blackman & Eastop 2020).

Distribution: Arizona, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Idaho, Illinois, Indiana, Kansas, Louisiana, Maine, Maryland, Montana, Nebraska – first USA record in 1891 (Foottit et al. 2006), New Jersey, New York, Ohio, Oregon, Pennsylvania, South Dakota, Texas, Utah, Virginia, Washington.

Material examined: CANADA, **Ontario**, Burlington, 2 al. viv. fem., *Chrysanthemum* sp., 15.08.1965, leg. A. G. Robinson, 010015831; USA, **California**, Berkeley, 3 apt. viv. fem., 3 al. viv. fem., *Chrysanthemum* sp., 17.04.1935, leg. Essig, 010015946 (NHM); **Colorado**, Fort Collins, 8 apt. viv. fem., *Chrysanthemum* sp., 22.10.1909, leg. Bragg, 010015838 (NHM); **District of Columbia**, Washington, 1 apt. viv. fem., *Chrysanthemum* sp., 23.05.1916, leg. J. Kotinsky, 010015834 (NHM); **Maryland**, Prince George's Co., Greenbelt, 2 apt. viv. fem., 1 al. viv. fem., *Chrysanthemum* sp., 10.05.1999, leg. A. Jensen, AJ1646 (AJ), 2 apt. viv. fem., AJ1647 (AJ), 2 apt. viv. fem., AJ1648 (AJ); **New York**, Staten Island, Castleton Corners, 1 al. viv. fem., pan traps, 01–07.09.1963, leg. E. A. Rundlatt, 010015839 (NHM); **Oregon**, Benton Co., Corvallis, 1 apt. viv. fem., *Chrysanthemum* sp., 28.10.1990, leg. A. Jensen, AJ481 (AJ), Washington Co., Tigard, 2 apt. viv. fem.,

08.10.2008, AJ3412 (AJ); **Utah**, St. George, 2 apt. viv. fem., *Chrysanthemum* sp., 12.05.1958, leg G. F. Knowlton, 010015832 (NHM), Castle Dale, 2 al. viv. fem., 14.05.1958, 010015833 (NHM),

Macrosiphoniella (*Macrosiphoniella*) *subterranea* (Koch, 1855)

Siphonophora subterranea Koch, 1855: 155

Masked oxeye aphid

Figures 2c and 4d

Colour in life: Apterous viviparous females are reddish-brown, covered by a thick layer of wax-powder on almost whole body except one large spino-pleural patch with two pairs of spinal wax spots on ABD II–III and two pleural patches on ABD V–VI around SIPH. ANT dark except yellow to pale ANT III and basal part of ANT IV. Femora shiny dark brown to black with yellow basal parts, tibiae yellow to light brown with black proximal and distal ends. Siphunculi and cauda uniformly black. Alate viviparous females very similar in colouration to apterae, also thick wax-powdered with similar areas free of wax. Antennae dark with paler basal part of ANT III. Legs with black femora with very proximal parts yellow and yellow tibiae with black proximal and distal ends. Siphunculi and cauda black (Heie 1995; Blackman & Eastop 2020).

Pigmentation on slide: Apterous viviparous females with head sclerotized, brown, and brown antennae with yellow to light brown ANT III, basal part of ANT IV and PT. Femora dark brown, yellow basally, tibiae yellow to light brown with dark brown to black basally and apically. Abdomen with pale brown scleroites at setal bases and antesiphuncular sclerites, uniformly dark brown SIPH and sometimes slightly paler cauda (Figure 2d). Alate viviparous females with sclerotized, brown to dark brown head and thorax. Antennae in general brown with slightly paler basal and distal part of ANT III and basal half of ANT IV. Femora dark brown with paler proximal parts. Tibiae yellow with brown proximal and distal ends. Abdomen with poorly pigmented, small scleroites at setal bases and light brown antesiphuncular and marginal sclerites. Siphunculi and cauda uniformly brown (Figure 4e).

Host plants and biology: This species feeds mostly undersides of leaves of *Leucanthemum vulgare* (= *Chrysanthemum leucanthemum*) and other species from this genus. It can also be found on *Leucanthemum maximum* (= *Ch. maximum*) and the feeding causes yellow spots on the plant. This is a holocyclic species with oviparae and alate males in October and November (Heie 1995; Blackman & Eastop 2020).

Distribution: Pennsylvania – first USA report in 1948, Oregon.

Material examined: CANADA, **Ontario**, Toronto, 4 apt. viv. fem., *Chrysanthemum leucanthemum*, 17.09.1972, leg., Sÿpkens, 010014334 (NHM); NETHERLANDS, Bennekom, 2 apt. viv. fem., 2 al. viv. fem., *Ch. maximum*, 11.08.1965, leg. D. Hille Ris Lambers, 010014339 (NHM), UK, Herpenden, 2 apt. viv. fem., *Leucanthemum vulgare*, 10.07.1960, leg. R. N. B. Prior, 010014356 (NHM), 3 al. viv. fem., 010014364 (NHM), USA, **Oregon**, Douglas Co., Umpqua N.F. Rd. 27 west, 3 apt. viv. fem., *Chrysanthemum leucanthemum*, 03.05.2014, leg. A. Jensen, AJ7130 (AJ); **Pennsylvania**, Black Moshannon State Park, 1 apt. viv. fem., *Ch. leucanthemum*, 06.08.1966, leg. H. Stroyan, 010014330 (NHM), Red Rock, 2 apt. viv. fem., 1 al. viv. fem., *Ch. leucanthemum*, 30.08.1950, leg. J. O. Pepper, 010014331 (NHM), State College, 2 apt. viv. fem., 1 al. viv. fem., 30.09.1949, 010014329 (NHM).

Macrosiphoniella (*Macrosiphoniella*) *sunshine* sp. nov.

Oregon Sunshine aphid

http://zoobank.org/urn:lsid:zoobank.org:pub:A15D7190-8E74-4AC6-84B2-6B8AE9A4454 C

http://zoobank.org/urn:lsid:zoobank.org:act:3C3FA8B4-9EA5-4F09-ABF0-31EDC3826E13

Fundatrix – description (n = 1)

(Figure 6, 8 Table I)

Colour in life: Light green with darker green longitudinal spinal stripe from mesonotum to ABD VII and two dark green patches around siphuncular bases. Antennae black, legs light brown with darker knee areas and distal parts of tibiae and tarsi. Siphunculi light green at the bases, then brown to dark. Cauda yellowish.

Pigmentation on slide: Light yellow. Head more or less yellow, sometimes with darker bands laterally between eyes and antennae. Antennae brown except ANT I–II and base of III paler. URS brown, rostral segment III yellow to brown. Femora yellow with apical $^1/_3$ becoming brown, especially dorsally and ventrally, with a paler band subapically. Tibiae mostly yellow, but extreme base and apical part brown. Tarsi brown. Thorax and ABD pale except SIPH which are brown; antesiphuncular sclerites and dorsal abdominal scleroites present but pale; cauda as SIPH (Figure 6a).

Morphometric characters. Antennal tubercles internally with 3 setae. Head setae 0.045–0.060 mm long. ANT 1.33–1.36 × BL, HW 0.13 × ANT. PT 4.84–5.00 × BASE. Other antennal ratios: ANT VI PT/ANT

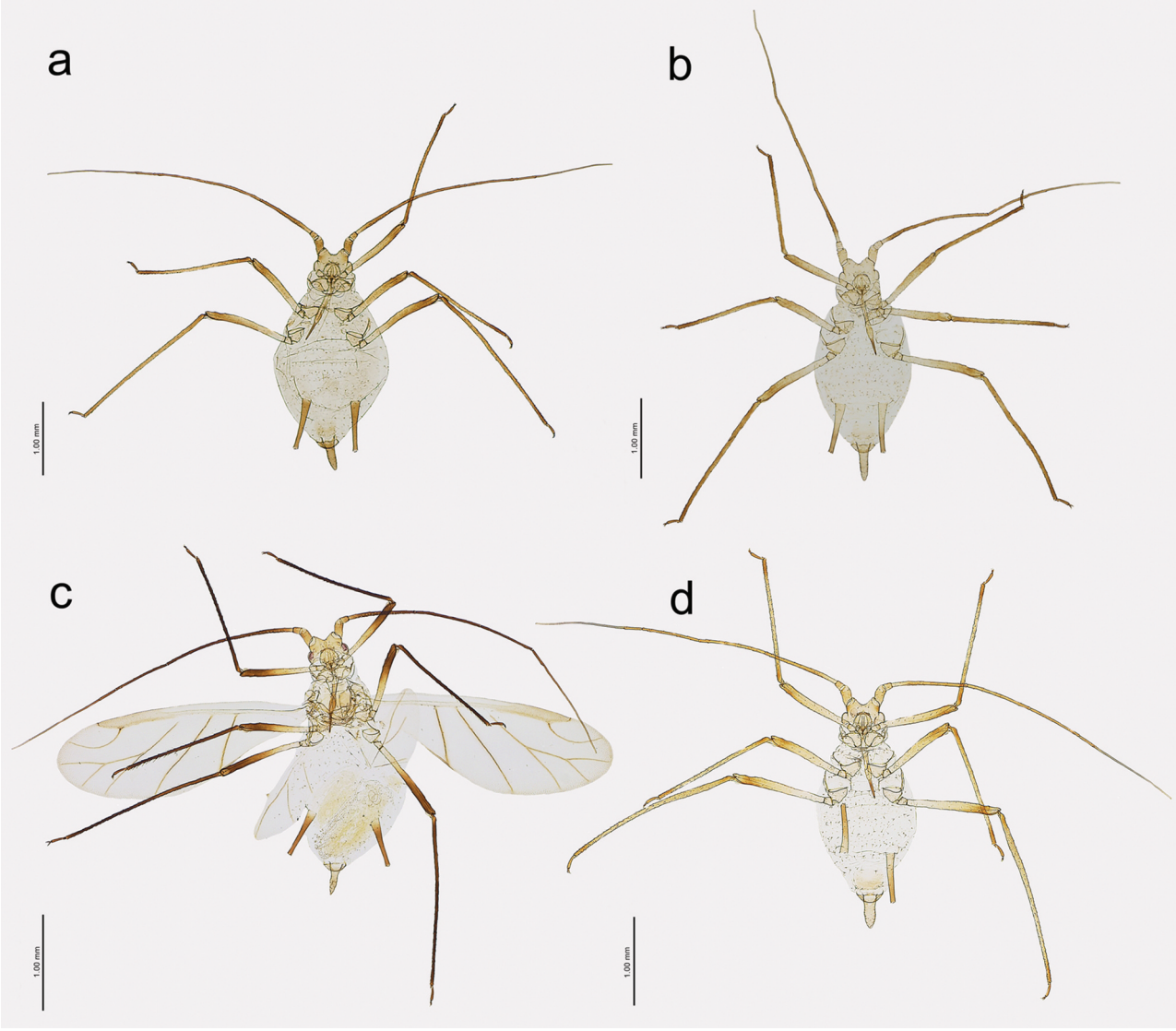

Figure 6. *Macrosiphoniella sunshine* **sp. nov**. (a) fundatrix, (b) apterous viviparous female, (c) alata viviparous female, (d) oviparous female.

III 1.45, ANT VI/ANT III 1.74–1.75, ANT V/ANT III 0.83–0.85, ANT IV/ANT III 0.93–094. ANT III with 39–40 secondary rhinaria reaching over half of the segment length and with 19–20 setae, ANT IV with 16–17 setae, ANT V with 11–12 setae, ANT VI with 4–5 basal setae and 3–6 situated on the PT. LS III 0.80–0.90 × BD III. URS 0.32–0.33 × ANT III, 0.18–0.19 × ANT VI and 1.64 × HT II. Hind tibiae with 1–2 pseudosensoria (Figure 8h). Posterior seta on hind trochanter 0.63–0.71 × trochantro-femoral suture. HT II 0.19–0.20 × ANT III, 0.68 × BASE and 0.18–0.19 ANT VI. Dorsal setae 0.040–0.045 mm long on thorax, 0.040–0.055 on ABD I–V and 0.050–0.060 on ABD VI–VIII. ABD VIII with 7 setae. SIPH 0.82–0.84 × ANT III and 1.40–1.42 × cauda, tubular, tapering. Genital plate with 2 anterior, 6 median and 8 posterior setae. Cauda with 25 setae.

Remarks: This early spring morph can be distinguished from the apterous viviparous females by the few pseudosensoria on hind tibiae, longer PT – 1.21–1.25 (0.68–1.14 in apterae) and higher ratio URS/HT II – 1.64 (1.35–1.58 in apterae).

Apterous viviparous female – description
(n = 47)(Figure 4d, 5–7, 9–12; Table I)

Colour in life: Light green with darker green longitudinal spinal stripe from mesonotum to ABD VII and two dark green patches around siphuncular bases. Antennae black, legs light brown with darker

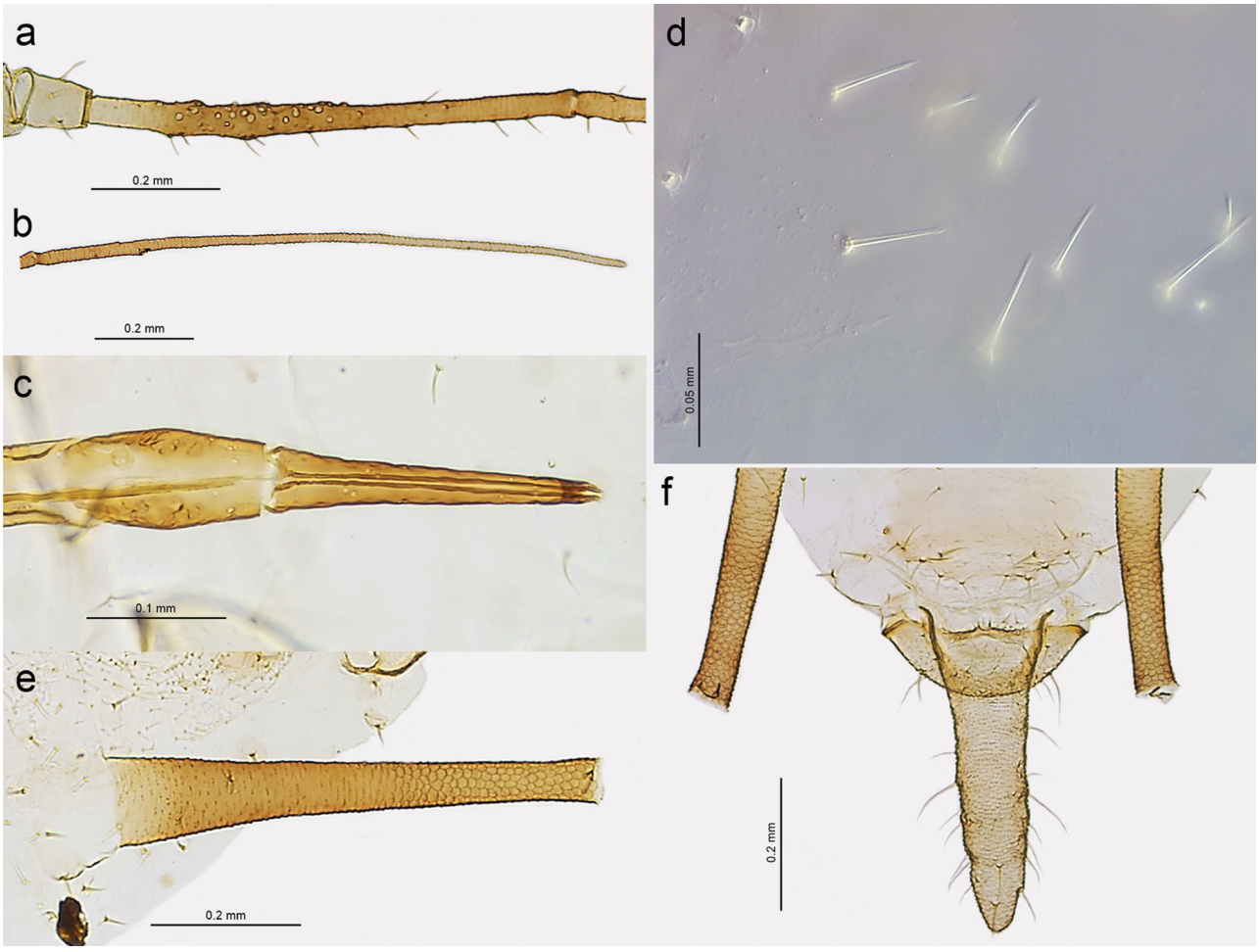

Figure 7. Morphological characters of apterous viviparous females of *Macrosiphoniella sunshine* **sp. nov**. (a) ANT III, (b) ANT VI, (c) URS, (d) dorsal abdominal chaetotaxy, (e) SIPH, (f) cauda.

knee areas and distal parts of tibiae and tarsi. Siphunculi light green at the bases, then brown to dark. Cauda yellowish (Figure 5a).

Pigmentation on slide: Mostly pale to light yellow. Head more or less pale, sometimes with dark bands laterally between eyes and antennae. Antennae brown except ANT I–II and base of III paler. URS brown, rostral segment III yellow to brown. Femora yellow with apical ½ becoming brown, especially dorsally and ventrally, with a paler band subapically. Tibiae mostly yellow, but extreme base and apical part brown. Tarsi brown. Thorax and ABD pale except SIPH which are brown over apical half to more or less entirely brown; antesiphuncular sclerites and dorsal abdominal scleroites present but more or less pale; cauda yellow to light brown, much paler than apical part of SIPH (Figure 6b).

Morphometric characters. Antennal tubercles internally with 3–4 setae. Head setae 0.040–0.060 mm long. ANT 1.07–1.84 × BL, HW 0.12–0.15 × ANT. PT 3.23–5.68 × BASE. Other antennal ratios: ANT VI PT/ANT III 0.82–1.48, ANT VI/ANT III 1.08–1.74, ANT V/ANT III 0.59–0.92, ANT IV/ANT III 0.63–1.06. ANT III with 12–53 secondary rhinaria from near the base to about the mid-point of the segment (Figure 7a) and with 11–22 setae, ANT IV with 8–17 setae, ANT V with 6–14 setae, ANT VI with 3–4 basal setae and 2–10 situated on the PT (Figure 7b). LS III 0.88–1.25 × BD III. URS (Figure 7c) 0.26–0.32 × ANT III, 0.16–0.26 × ANT VI, 0.99–1.23 × BASE, 0.19–0.35 × PT and 1.19–1.58 × HT II. Posterior seta on hind trochanter 0.60–0.80 × trochantro-femoral suture. HT II 0.17–0.24 × ANT III, 0.-72–0.90 × BASE and 0.12–0.19 ANT VI. Dorsal setae (Figure 7d) 0.030–0.055 mm long on thorax, 0.020–0.055 on ABD I–V and 0.040–0.065 on ABD VI–VIII. ABD VIII with 6–8 setae. SIPH (Figure 7e) 0.63–0.86 × ANT III, 1.10–1.46 × cauda, tapering.

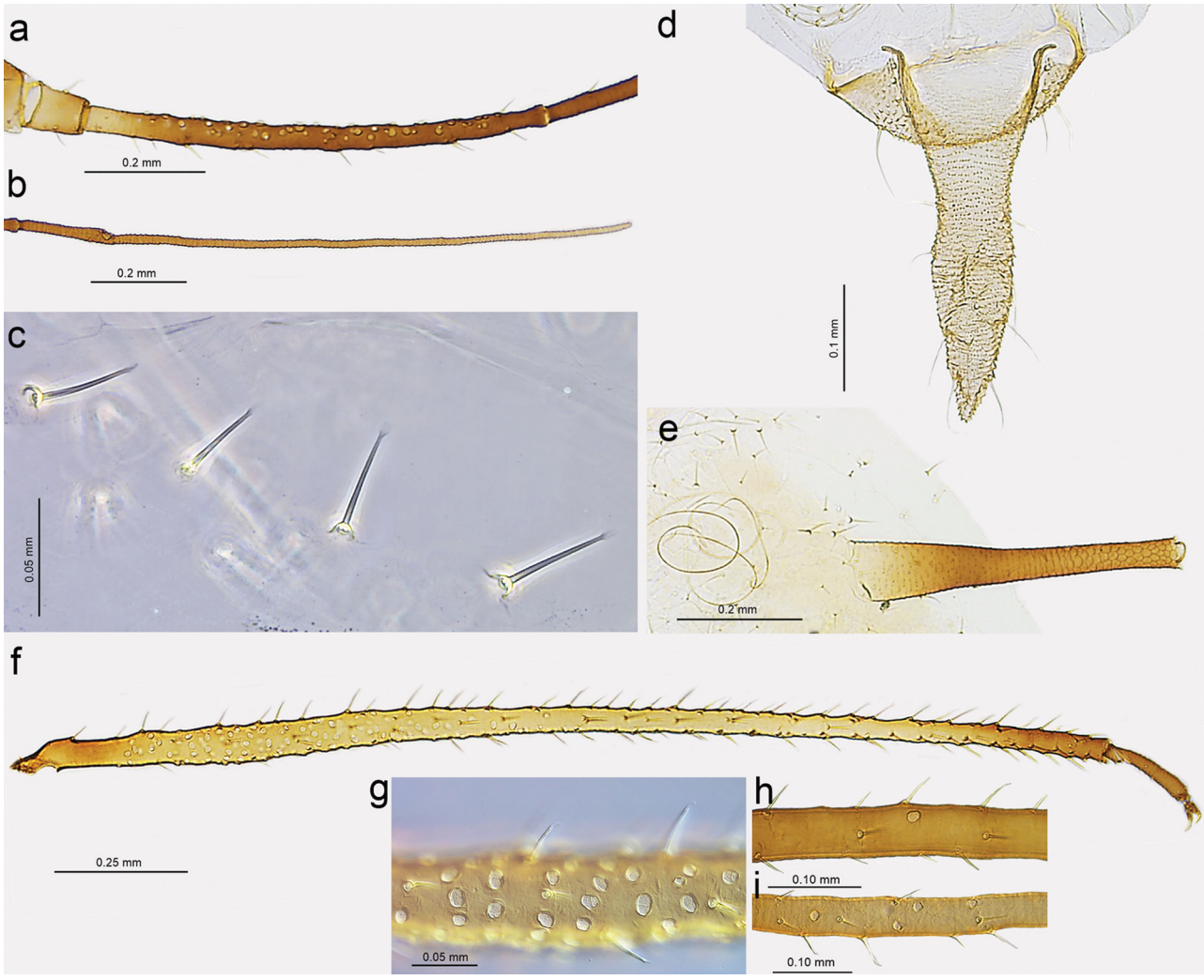

Figure 8. Morphological characters of alate viviparous and oviparous females of *Macrosiphoniella sunshine* **sp. nov**. (a) ANT III, (b) ANT VI, (c) dorsal abdominal chaetotaxy, (d) cauda, (e) SIPH, (f) hind tibia of oviparous female, (g) pseudosensoria on hind tibia of oviparous female, (h) fragment of hind tibia of fundatrix with one pseudosensorium, (i) fragment of hind tibia of early autumnal aptera with few pseudosensoria.

Genital plate with 2–7 anterior and 7–12 posterior setae. Cauda often pointed, with 15–26 setae (Figure 7f).

SEM morphology. Body of apterous viviparous females covered by thin wax layer in form of short, thin, very often curly and ribbed secretions (Figure 9a-c). Ultimate rostral segments are long and very narrow with hardly separated R IV and V and about 4–6 short, very fine and pointed accessory setae (Figure 9d). The very distal end of RV bears four pairs of slightly curved type III basiconic sensilla (Figure 9e). Hind tarsi are characterized by short, triangular first segments that bear three setae (trichoid sensilla) ventrally (two longer and one "sense peg"). Second segment of hind tarsus bearing short and rigid trichoid sensilla and long, flattened and blunt parempodia (empodial setae) (Figure 9f-g). Siphunculi are slightly imbricated on the basal part with very well-developed polygonal reticulation in form of pentagons to octagons and quite well-developed flange (Figure 9h-i). Cauda is robust, very slightly constricted in the 1/3 of the length and bears long and median in length, fine and slightly capitate setae (Figure 9j-l).

Antennae are characterized by presence of five types of sensilla. All antennal segments bear thick, rigid type I trichoid sensilla. Type I trichoid sensilla arising from protuberant, trapezoid sockets, are tubular, striped and characterized mostly by capitate

Table I. Measurements (in mm) of known morphs of *Macrosiphoniella sunshine* **sp. nov.**

Character	Fundatrix	Apterous viviparous female	Alate viviparous female	Oviparous female
BL	3.07	1.78–3.25	2.21–2.87	2.11–2.70
HW	0.55	0.42–0.65	0.44–0.50	0.44–0.48
ANT	4.11–4.21	3.02–4.19	3.66–4.09	3.07–3.77
ANT III	0.83–0.86	0.62–0.96	0.74–0.86	0.75–0.86
ANT IV	0.80–0.81	0.53–0.87	0.70–0.84	0.55–0.77
ANT V	0.71–0.72	0.49–075	0.60–0.74	0.60–0.63
ANT VI	1.46–1.50	0.89–1.45	1.22–1.34	1.03–1.29
BASE	0.25	0.18–0.24	0.19–0.22	0.18–0.22
PT	1.21–1.25	0.68–1.22	1.00–1.12	0.85–1.07
URS	0.28	0.20–0.25	0.23–0.27	0.21–0.23
FEMORA III	1.15–1.17	0.78–1.17	0.92–1.10	0.85–1.09
TIBIAE III	2.20–2.25	1.19–2.26	1.87–2.15	1.55–2.03
HT II	0.17	0.14–0.19	0.16–0.20	0.14–0.17
SIPH	0.70	0.47–0.73	0.48–0.60	0.46–0.61
CAUDA	0.71	0.35–0.56	0.36–0.41	0.35–0.39

apices and sometimes with heart-shaped ones (Figure 10a-f). Antennal segment III additionally bears many different-size, mostly rounded and protuberant multiparous placoid sensilla (secondary rhinaria) which are lying in cuticle cavities surrounded by sclerotic rims (Figure 10g-h). Antennal segment V is characterized by the presence of inconspicuous big multiparous placoid sensillum (primary rhinarium) which lies deep in the cuticle and is surrounded by sclerotic rim with about 17–20 mostly slightly pointed projections (Figure 10i-j). Primary rhinaria on ANT VI closely adjoin each other and consist of big multiparous placoid sensillum (major rhinarium) which lies deep in the cuticle and is surrounded by 19–22 projections; accessory rhinaria are located perpendicularly with two small multiparous placoid sensilla in polar positions and sunken coeloconic sensilla in the area between big and small placoid sensilla (Figure 10k). Processus terminalis of ANT VI bears 3–4 short, rigid and thick type II trichoid sensilla (apical and subapical setae) with slightly rounded apices (Figure 10l).

Dorsal side of body and legs are characterized by trichoid sensilla very similar to those on antennae. Those on head, thorax, and abdomen are long, rigid, and always with capitate apices (Figure 11a-c, j-k); they arise from protuberant, trapezoid sockets and are strongly striped on entire length (Figure 11d). Trichoid sensilla on femora are very similar like those on the dorsum (Figure 11e). Tibiae bear numerous long trichoid sensilla and depending on the exact location are like those on the rest of the body with capitate apices – almost whole length of the tibiae (Figure 11g), some longer ones with slightly flattened and blunt or slightly bifurcated apices on the distal outer area of tibiae (Figure 11h), and robust ones with pointed apices on the distal inner area of tibiae (Figure 11i). Trichoid sensilla on dorsal abdomen are similar to those on the head and thorax (Figure 11j), some of them arising from oval scleroites (Figure 11k). Like other sensilla on the dorsal side of body they arise from protuberant and trapezoid sockets, are striped, and have capitate apices (Figure 11l).

Alate viviparous female – description (n = 9) (Figure 4e, 6, 8; Table I)

Colour in life: Light green with darker longitudinal stripe on abdomen and two darker patches around SIPH.

Pigmentation on slide: Mostly pale to light yellow. Head more or less pale to light brown, darker around ocelli. Antennae more or less entirely brown, with ANT I–II and extreme base of ANT III lighter brown. URS and rostral segment III brown. Thoracic sclerites light brown. Femora yellow basally, becoming brown by mid-point, extreme apex often slightly paler. Tibiae entirely brown to brown only basally and apically. Tarsi brown. Abdomen pale except SIPH brown, paler near base, and cauda yellow to light brown (Figure 6c).

Morphometric characters. Antennal tubercles internally with 3–4 setae. Head setae 0.030–0.050 mm long. ANT 1.27–1.66 × BL, HW 0.11–0.13 × ANT. PT 4.54–5.73 × BASE (Figure 8b). Other antennal ratios: ANT VI PT/1.25–1.50, ANT VI/ANT III 1.52–1.77, ANT V/ANT III 0.78–0.86, ANT IV/ANT III 0.90–1.00. ANT III with 40–56 secondary rhinaria on the whole length and with 14–17 setae (Figure 8 a), ANT IV sometimes with 1–6 secondary rhinaria and with 14–17 setae, ANT V with 9–10 setae, ANT VI with 3–4 basal setae and 10–12 situated on the PT. LS III 1.00–1.12 × BD III. URS 0.30-.36 × ANT III, 0.17–0.21 × ANT VI, 1.15–1.35 × BASE, 0.20–0.26 × PT and 1.30–1.58 × HT II. Posterior seta on hind trochanter 0.66–0.84 × trochantro-femoral suture. HT II 0.21–0.23× ANT III, 0.77–0.90 × BASE and 0.12–0.14 ANT VI. Dorsal setae 0.040–0.050 mm long on thorax, 0.035–0.055 on ABD I–V and 0.045–0.055 on ABD VI–VIII (Figure 8 c). ABD VIII with 5–7 setae. SIPH 0.63–0.73 × ANT III and 1.26–1.50 × cauda, tubular, tapering (Figure 8 d, e). Genital plate with 2–4 anterior (sometimes 2 median) and 7–10 posterior setae. Cauda with 14–22 setae.

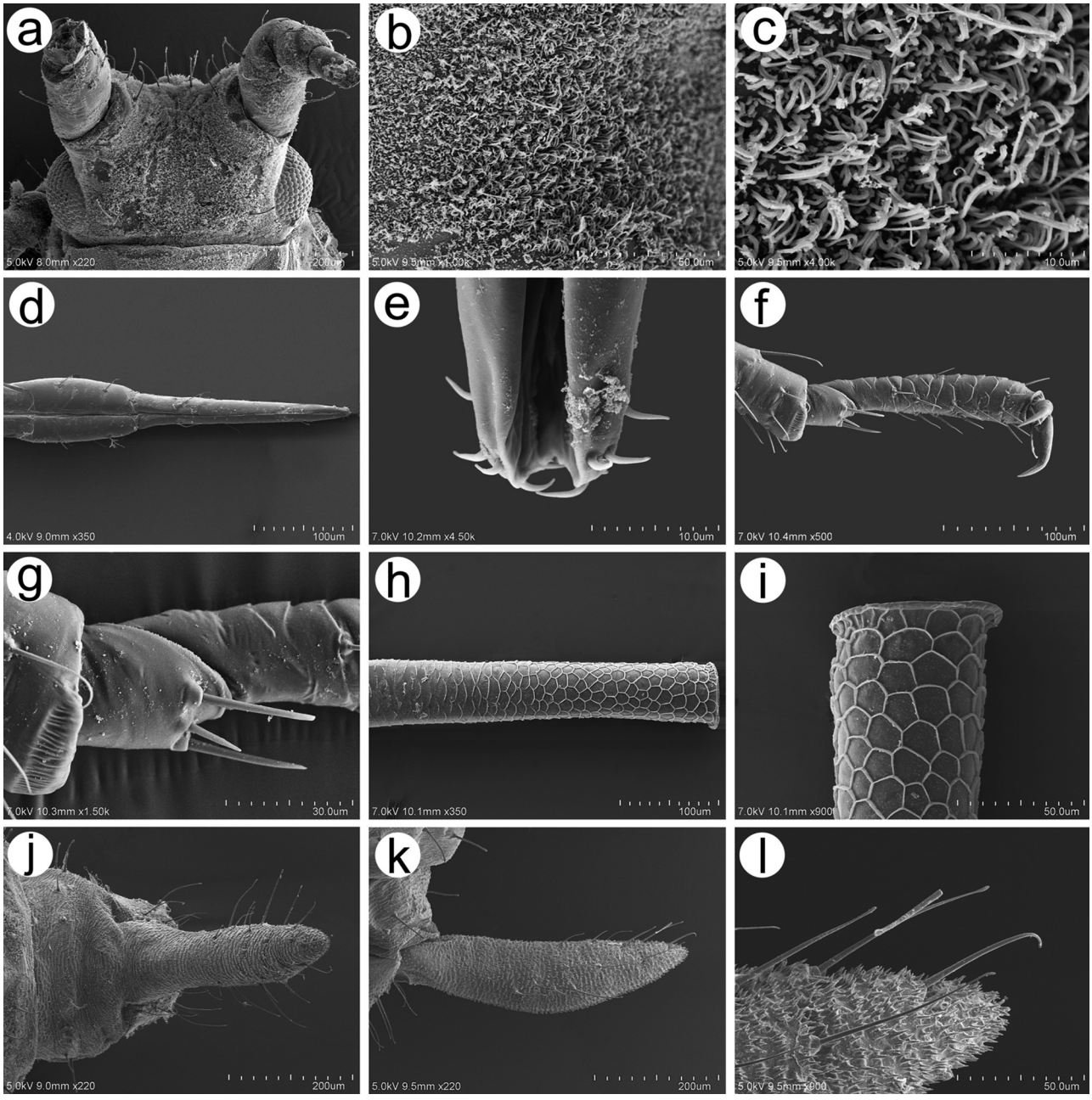

Figure 9. SEM of apterous viviparous females of *Macrosiphoniella sunshine* **sp. nov**. (a) head covered by wax-powder, (b) waxy secretions on the dorsal side of body, (c) ultrastructure of the waxy secretions, (d) URS, (e) sensilla of the tip of URS, (f) end of tibia and hind tarsus, (g) first segment of hind tarsus, (h) SIPH, (i) ultrastructure of subapical polygonation, (j) dorsal side of cauda, (k) lateral side of cauda, (l) caudal chaetotaxy.

Oviparous female – description (n = 16) (Figure 6, 8; Table I)

Colour in life: Light green with darker longitudinal stripe from mesothorax to ABD VI and two darker patches around SIPH.

Pigmentation on slide: Mostly pale to yellow. Head more or less yellow, with dark bands laterally between eyes and antennae. Antennae more or less entirely yellow to light brown, with ANT I–II and extreme base of ANT III slightly paler. URS brown. Thorax pale. Femora yellow, becoming brown at distal part with extreme apex slightly paler. Tibiae yellow brown with brown proximal and distal ends. Tarsi brown. Abdomen pale except SIPH brown, paler near base, and yellow cauda (Figure 6 d).

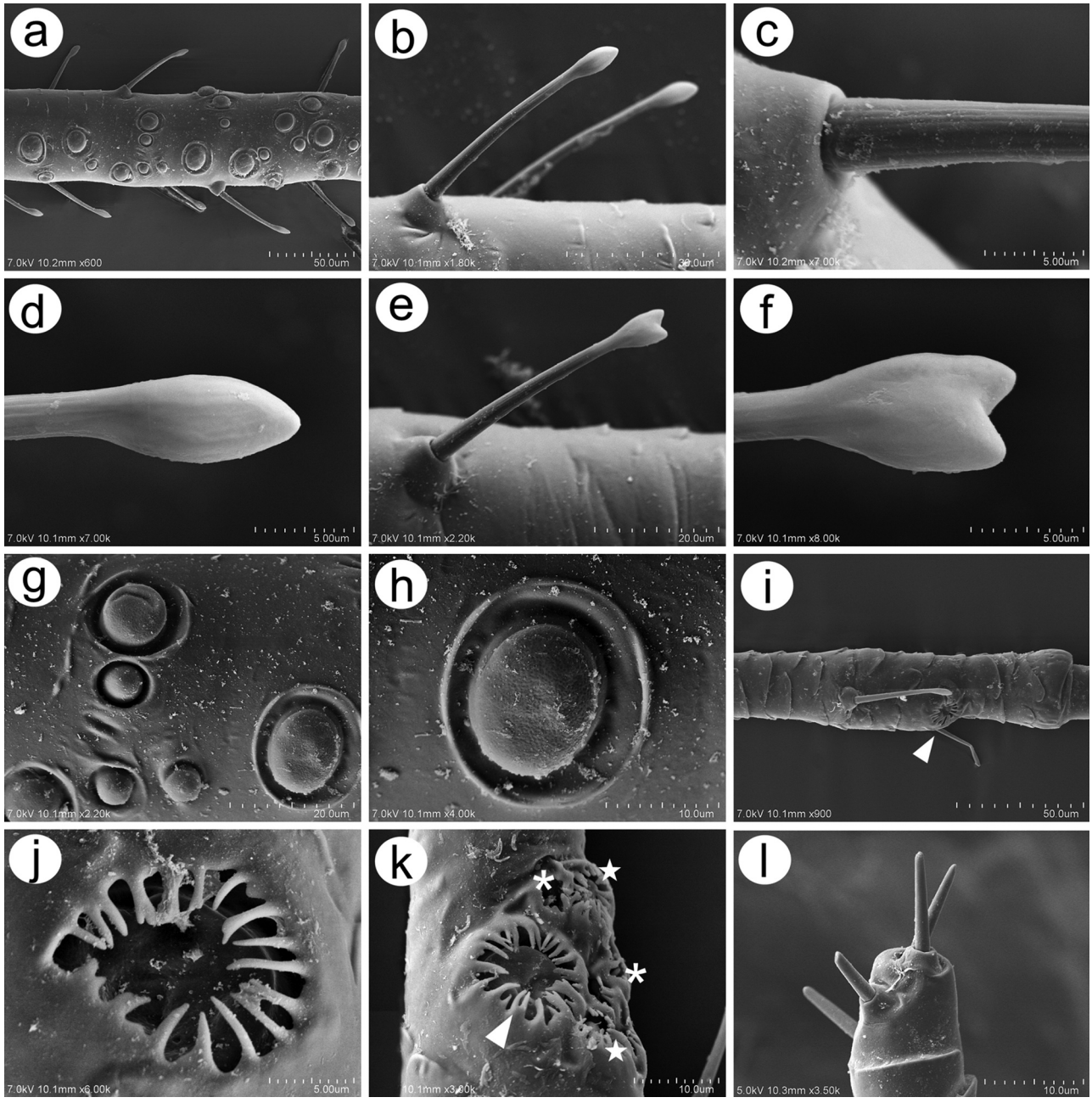

Figure 10. SEM of apterous viviparous females of *Macrosiphoniella sunshine* **sp. nov**. (a) fragment of ANT III with sensilla, (b) trichoid sensilla on ANT III with capitate apices, (c) ultrastructure of basal part of trichoid sensillum, (d) ultrastructure of the tip of trichoid sensillum, (e) trichoid sensilla on ANT III with heart-shaped apex, (f) ultrastructure of the tip of trichoid sensillum, (g) placoid sensilla on ANT III, (h) ultrastructure of placoid sensillum on ANT III, (i) big placoid sensillum on ANT V, (j) ultrastructure of the big placoid sensillum on ANT V, (k) group of sensilla on ANT VI: big placoid sensillum (arrowhead), small placoid sensilla (stars), sunken coeloconic sensilla (asterisks), (l) trichoid sensilla on the tip of PT of ANT VI.

Morphometric characters. Antennal tubercles internally with 3–4 setae. Head setae 0.040–0.058 mm long. ANT 1.25–1.60 × BL, HW 0.12–0.14 × ANT. PT 4.59–5.94 × BASE. Other antennal ratios: ANT VI PT/ANT III 1.08–1.33, ANT VI/ANT III 1.30–1.61, ANT V/ANT III 0.66–0.76, ANT IV/ANT III 0.73–0.92. ANT III with 18–27 secondary rhinaria from the basal part to about the half of their length and with 16–17 setae, ANT IV with 14–16 setae, ANT V with 7–10 setae, ANT VI with 3–4 basal setae and 6–9 situated on the PT. LS III 0.93–1.11 × BD III. URS 0.26–0.29

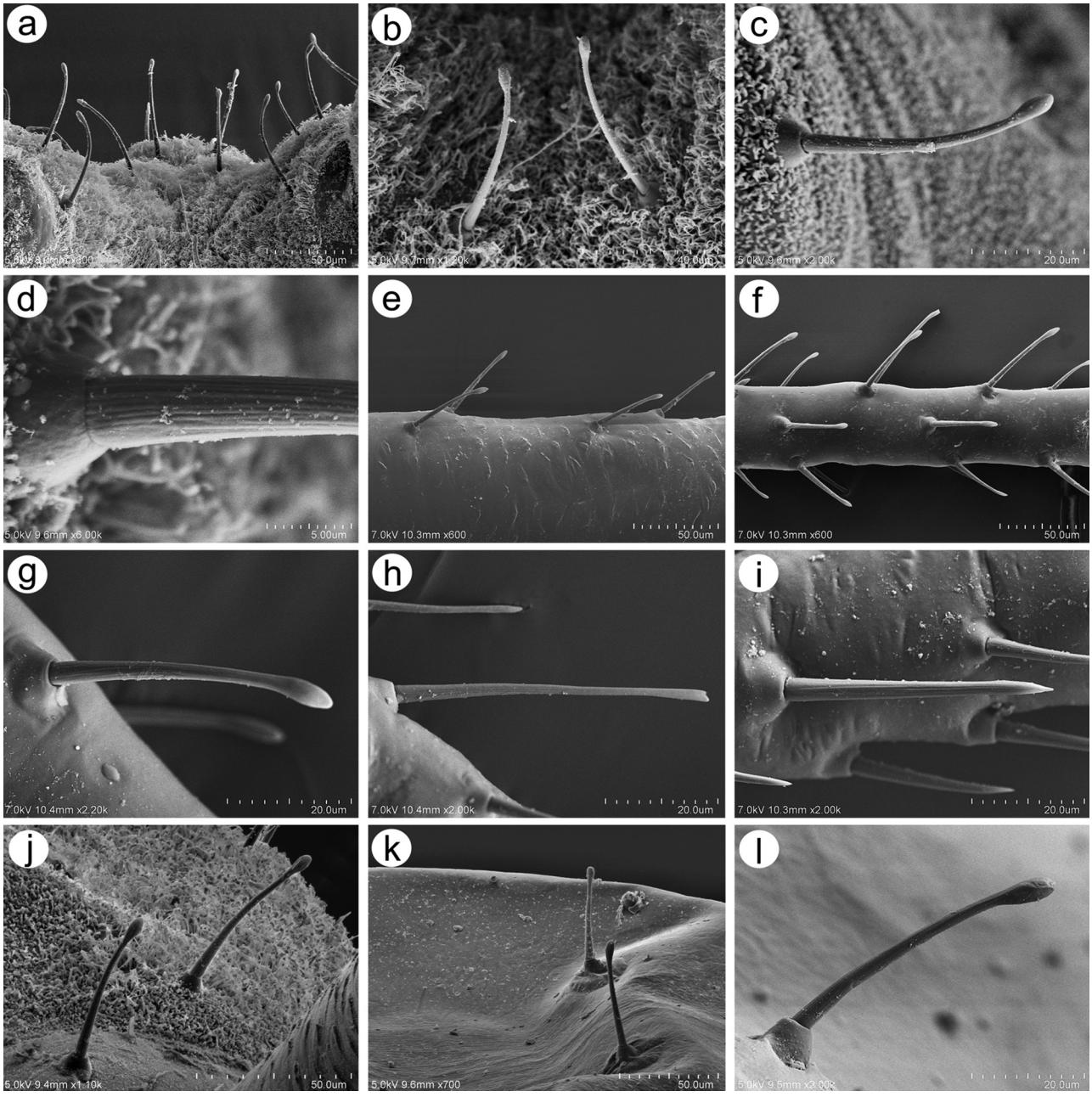

Figure 11. SEM of apterous viviparous females of *Macrosiphoniella sunshine* **sp. nov**. (a) head chaetotaxy, (b) head trichoid sensilla, (c) trichoid sensillum on thorax, (d) ultrastructure of the basal part of the trichoid sensillum on thorax, (e) trichoid sensilla on hind femora, (f) trichoid sensilla on hind tibia, (g) trichoid sensilla on hind tibia with capitate apices, (h) trichoid sensilla on hind tibia with blunt apices, (i) trichoid sensilla on hind tibia with pointed apices, (j, k) trichoid sensilla on the dorsal side of abdomen, (l) ultrastructure of the sensillum.

× ANT III, 0.17–0.20 × ANT VI and 1.32–1.50 × HT II. Hind tibiae slightly swollen, with 58–100 circular or oval, whole or 8-shaped pseudosensoria (Figure 8 f, g). Posterior seta on hind trochanter 0.74–-0.89 × trochantro-femoral suture.HT II 0.18–0.20 × ANT III, 0.72–0.83 × BASE and 0.17–0.20 ANT VI. Dorsal setae 0.030–0.056 mm long on thorax, 0.-042–0.062 on ABD I–V and 0.041–0.060 on ABD VI–VIII. ABD VIII with 7–9 setae. SIPH 0.56–70 × ANT III and 1.25–1.44 × cauda, tubular, slightly tapering. Genital plate with 2 anterior, 4–6 median and 12–13 posterior setae. Cauda with 30–35 setae.

Differential Diagnosis. The new species is morphologically close to *M. ludovicianae*. Apterous viviparous females differ from those of *M. ludovicianae* by several differences in live and mounted specimens. Such as:

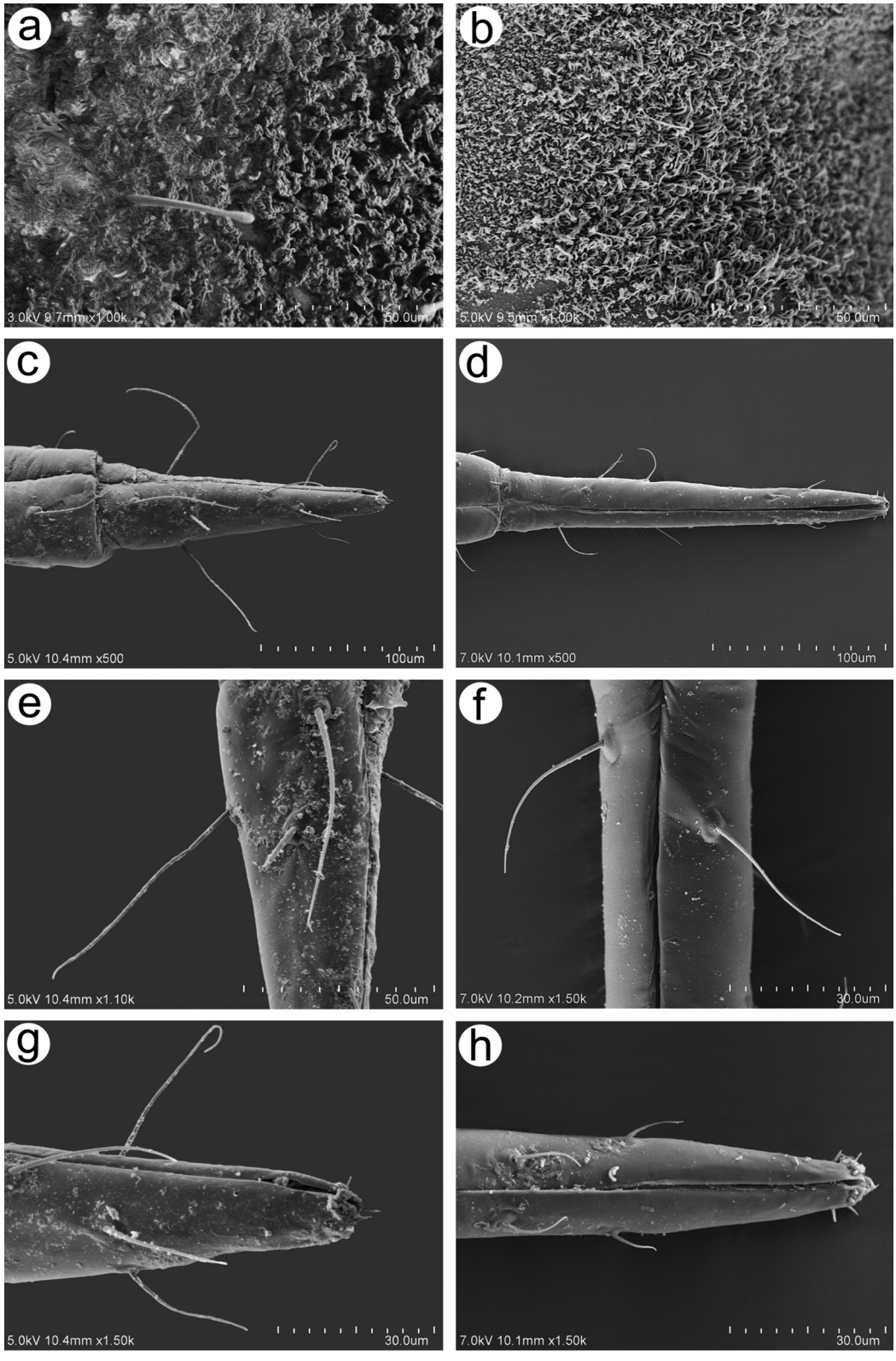

Figure 12. SEM morphological differences between *Macrosiphoniella ludovicianae* (a, c, e, g) and *M. sunshine* **sp. nov**. (b, d, f, h): (a, b) structure of waxy secrections, (c, d) length of URS, (e, f) length of accessory setae on URS, (g, h) length of primary setae on URS.

- Dark green longitudinal spinal stripe and patches near SIPH bases on the abdomen (dorsum uniformly green in *M. ludovicianae*).
- Longer and narrower URS (Figure 12d) (short and slightly stiletto-shaped in *M. ludovicianae* (Figure 12c).
- Higher ratio of: URS/ANT III 0.26–0.32, URS/BASE 1.04–1.02, URS/PT 0.20–0.35, URS/ANT VI 0.17–0.26 and URS/HT II 1.35–1.58 (lower ratio of those lengths in *M. ludovicianae*: URS/ANT III 0.16–0.21, URS/BASE 0.66–0.80, URS/PT 0.15–0.18, URS/ANT VI 0.12–0.15 and URS/HT II 0.82–0.92, respectively).
- Shorter accessory setae on URS – 0.025–0.030 mm long (0.09–0.10 mm long in *M. ludovicianae*) (Figure 12e-f).
- Very often more secondary rhinaria (usually 20–53, only in one specimen 12–17) on ANT III from the base to the mid-point or more of the segment (usually 7–17 secondary rhinaria on the basal ¼ or so of ANT III in *M. ludovicianae*).
- In addition, there are differences between apterous viviparous females of these morphologically similar species in structure of waxy secretion (Figure 12 a, b) and in length of primary setae on URS (Figure 12 g, h).

Alate viviparous females of *M. sunshine* differ from those of *M. ludovicianae* in:

- URS longer than HT II with shorter accessory setae (URS shorter than HT II with longer accessory setae in *M. ludovicianae*).
- Higher ratio of URS/HT II 1.30–1.58; URS/ANT III 0.30–0.36; URS/ANT VI 0.17–0.21; URS/BASE 1.15–1.35; SIPH/ANT III 0.63–0.73;PT/ANT IV 1.33–1.58 (lower ratio of those lengths of *M. ludovicianae*: URS/HT II 0.75–0.94; URS/ANT III 0.14–0.20; URS/ANT VI 0.11–0.16; URS/BASE 0.64–0.80; SIPH/ANT III 0.46–0.61; PT/ANT IV 1.21–1.29 respectively).

Oviparous females of *M. sunshine* differ from those of *M. ludovicianae* in:

- ANT III with 18–27 secondary rhinaria (8–9 secondary rhinaria in *M. ludovicianae*).
- Cauda with 30–35 setae (cauda with 24–26 setae in *M. ludovicianae*).
- Higher ratio of PT/BASE 4.59–4.94; URS/HT II 1.32–1.50; URS/ANT III 0.26–0.29; URS/ANT VI 0.17–0.20; URS/PT 0.21–0.24; URS/BASE 1.02–1.22; SIPH/BL 0.20–0.22 (lower ratio of those lengths in *M. ludovicianae*: URS/HT II 0.82–0.83; URS/ANT III 0.15–0.17; URS/ANT VI 0.12–0.13; URS/PT 0.15–0.16; URS/BASE 0.62–0.64; SIPH/BL 0.17–0.18 respectively).

Etymology. The name of the new species is derived from the common name of the host plant "Oregon sunshine" (*Eriophyllum lanatum*) on which it was collected. For the purposes of the rules of nomenclature, the species name should be considered not Latin or latinized and therefore should be considered a random collection of letters without gender.

Host plant and biology. The new species is associated with Oregon sunshine, *Eriophyllum lanatum* (Pursh) J.Forbes. This plant lives in many different habitats from the ocean coast to semi-deserts east of the Cascade Mountains. All known samples of *M. sunshine* are from the relatively dry areas in the eastern parts of Washington, Oregon, and California, but it is not certain that the aphid does not also live in wet parts of its range. In the regions where we have collected *M. sunshine, E. lanatum* is a perennial that overwinters with above-ground foliage, starts growing very early in the spring, and blooms for an indefinite length of time based on the microhabitat. The aphids occur in spring on the overwintered leaves, then move onto developing flower stems. After flowering, aphids once again live on the leaves at ground level until sexuales are produced in late fall. The fundatrices occur in April (possibly in March in warmer parts of its range), together with the first alate viviparous females. Apterous viviparous females have been collected from April through mid-September. Alate viviparous females are not common, with only 12 specimens found in many years of hunting for this species. Sexuales are similarly difficult to find, occurring later than might be predicted based on the phenology of all the other nearby plants and aphids. Males of *M. sunshine* remain unknown.

Distribution. The new species so far has been collected in Washington, Oregon, and California although the host plant also occurs in British Columbia, Idaho, Montana, Nevada, Utah, and Wyoming. It is likely that *M. sunshine* occurs in one or more of these additional territories.

Material examined: **Holotype**. USA, **Oregon**, Lake Co., Fremont N. F., Winter Rim, 1 apt. viv. fem. (in the middle between two other aphids, indicated by a red circle and "H" letter), *Eriophyllum lanatum*, 24.06.2018, leg. A. Jensen, AJ10295 (USNM).

Paratypes. 2 apt. viv. fem. data the same as the holotype; **Oregon**, Lake Co., Warner Pass, 2 apt. viv. fem., *E. lanatum*, 2.05.2016, leg. A. Jensen, AJ8317

(AJ), 2 apt. viv. fem., 07.08.2016, AJ8804 (AJ), Hwy 140 at Warner Pass, 4 ♀, 01.10.2015, AJ8237 (AJ), 4 ♀, 01.10.2015, AJ8238 (AJ), 4 ♀, 01.10.2015, AJ8239 (AJ); N. Warner Mts., 1 apt. viv. fem., 15.09.2018, AJ10703 (AJ); Bullard Canyon area outside Lakeview, 2 apt viv. fem., 28.09.2018, AJ10751 (AJ), 3 apt. viv. fem., 28.08.2018, AJ 10,636 (AJ), Fermont N.F., Warner Mts. above Lakeview, 1 apt. viv. fem., 02.08.2018, AJ10588 (AJ), Paradise Lake, 4 1 apt. viv. fem., 04.08.2018, AJ 10,569 (AJ), Uranium mine area, 2 apt. viv. fem., 04.08.2018, Cottonwood Trail, 06.08.2017, AJ9565 (AJ), Dog Lake area, 3 ♀, 06.10.2018, AJ10770 (AJ), W. side of Lakeview valley, 3 apt. viv. fem., 15.09.2018, AJ10676 (IZISU), W. side of Lakeview valley, 1 al. viv. fem., 28.06.2018, AJ10276 (AJ), hill above Lakeview, 1 ♀, 20.10.2018, AJ10838 (AJ), Willamette N.F., Bunch Grass Ridge W. of Waldo Lake, 1 al. viv. fem., 14.07.2017, AJ9447 (DZUS), Gearhart Mt., 2 apt. viv. fem., 16.07.2016, AJ8650 (AJ), Winter Rim, 1 apt. viv. fem., 08.10.2016, AJ9113 (AJ); Douglas Co., Umpqua N. F., Clover Ridge, 2 apt. viv. fem., 03.05.2014, AJ7158 (AJ); Josephine Co., Illinois River near O'Brien, 3 al. viv. fem., 28.05.2011, AJ4809 (AJ); 1 apt. viv. fem., 1 al. viv. fem., AJ4808 (IZISU); **California**, Modoc Co., Modoc N.F. Warners Summit Trail, 4 apt. viv. fem., 23.08.2016, AJ8767 (DZUS); Siskiyou Co., Hwy 96 near Seiad, fundatrix, 1 al. viv. fem., 28.04.2014, AJ7102 (AJ), 2 apt. viv. fem., 1 al. viv. fem., 23.07.2017, AJ8766 (AJ); **Washington**, Kittitas Co., I-90 Nelson Siding, 2 apt. viv. fem., 1 al. viv. fem., 04.07.2008, AJ3236 (AJ), 3 apt. viv. fem., 09.07.2009, AJ3874 (AJ), Suncadia Resort, 3 apt. viv. fem., 20.06.2011, AJ5063 (AJ), 4 apt. viv. fem., AJ3873 (IZISU).

Macrosiphoniella (*Macrosiphoniella*) *tanacetaria* (Kaltenbach, 1843)

Aphis tanacetaria Kaltenbach, 1843: 19

Tansy aphid

Figures 2e and 4f

Colour in life: Apterous viviparous females green or pinkish-brown. Head grey-green (or pinkish-grey) very slightly wax-powdered with black antennae. Thorax light green (or pinkish-grey) due to uniform thin wax powder layer. Legs uniformly black, shiny. Abdomen green or pinkish with pleural patches or wax powder on ABD I–V and small paired spinal wax powder dots on ABD IV–VI. Sometimes wax powder forming pleuro-marginal areas on ABD I–IV and then ABD IV–VI with larger spinal paired patches on ABD IV–VI. Siphunculi and cauda uniformly black. Alate viviparous females very similar in colouration with head and thorax from grey-green to bluish-green. Antennae and legs black, shiny. Abdomen usually green with delicate wax powder on the spino-pleural and marginal areas. Siphunculi and cauda uniformly black.

Pigmentation on slide: Apterous viviparous females with front part of head sclerotized, brown. ANT dark brown to black with paler basal part of ANT III and PT. Legs dark brown to black with light brown basal half of fore femora and extreme bases of middle and hind femora. Abdomen with faintly pigmented, small antesiphuncular sclerites, uniformly dark brown SIPH and cauda (Figure 2f). Alate viviparous females with strongly sclerotized dark brown head and thorax and black ANT. Legs uniformly black except very basal parts of femora. Abdomen with hardly visible and pale antesiphuncular sclerites, uniformly dark brown to black SIPH and dark brown cauda (Figure 4g).

Host plants and biology: The species feeds commonly on *Tanacetum vulgare* and other species from this genus, where it can be found in large colonies mainly on the upper parts of stems and between the inflorescences. There are also records from *Achillea, Anthemis, Artemisia, Aster, Bidens, Chamaemelum, Chrysanthemum, Dendranthema, Matricaria*, and even *Salvia*. The oviparae and alate males occur from September to October (Heie 1995; Blackman & Eastop 2020).

Distribution: Connecticut – first USA report in 1909, Delaware, Maine, New Jersey, New York, Oregon, Pennsylvania, Washington.

Material examined: CANADA, **New Brunswick**, Fredericton, 1 apt. viv. fem., *Chrysanthemum* sp., 03.10.1956, leg. MacGillivray, 010014606 (NHM), **British Columbia**, Vancouver, Tsawwassen, 2 apt. viv. fem., 2 al. viv. fem., *Tanacetum vulgare*, 13.07.2013, leg. A. Jensen, AJ6608 (AJ); USA, **New York**, Albion, 2 apt. viv. fem., *Tanacetum vulgare*, 22.06.1960, leg. L. h. P, 010014502 (NHM), 1 apt. viv. fem., 1 al. viv. fem., 010014501 (NHM); Jam pond, 2 al. viv. fem., 28.07.1965, 010014509 (NHM); **Oregon**, Linn Co., Hwy 34 & Peoria Rd., 1 apt. viv. fem., 1 al. viv. fem., *Tanacetum vulgare*, 30.08.1991, AJ482 (AJ), Corvallis, 3 al. viv. fem., *T. vulgare*, 25.07.1970, leg. Swenson, 010014506 (NHM), **Pennsylvania**, Washington, 2 apt. viv. fem., 1 al. viv. fem., *T. vulgare*, 16.06.1954, leg. J. O. Pepper, 010014496 (NHM); **Washington**, Whatcom Co., Nooksack River nr. Ferndale, 1 apt. viv. fem., *T. vulgare*, 13.05.2014, leg. A. Jensen, AJ7251

(AJ), Skagit Co., Mount Vernon, 2 apt. viv. fem., 1 al. viv. fem., 11.07.2008, AJ3381 (AJ), 2 apt. viv. fem., 1 al. viv. fem., AJ3381 (AJ), 1 apt. viv. fem., 1 al. viv. fem., AJ3383 (AJ).

Macrosiphoniella (*Macrosiphoniella*) *tapuskae* (Hottes & Frison, 1931)

Macrosiphum tapuskae Hottes & Frison, 1931: 327

Large green yarrow aphid

Figures 2f and 4g

Colour in life: Head of apterous viviparous females yellow, with brown to dark antennae. Thorax greenish, legs brownish-green or yellowish-green with brown distal parts of femora and distal parts of tibiae. Abdomen pale to dark green with brownish siphunculi and yellowish cauda. On light green abdomen a darker area between siphunculi and near siphuncular bases is present. Alate viviparous females with similar abdomen colouration.

Pigmentation on slide: Apterous viviparous females in general yellow. Head slightly sclerotized, light brown. Antennae yellow to light brown with slightly darker ANT V and VI. Legs mostly yellow to pale brown with darker apical ends of femora, apical parts of tibiae, and tarsi brown. Siphunculi slightly s-curved, pale basally and then brown. Cauda yellow, paler than SIPH (Figure 1c). Alate viviparous females with sclerotized brown to light brown head and thorax. Antennae uniformly brown. Legs yellow to light brown with darker distal ends of femora and tibiae. Abdomen pale with brown SIPH, which are pale basally. Cauda paler than SIPH (Figure 3c).

Host plants and biology: In North America this species feeds usually on lower leaves of *Achillea millefolium* and *Anthemis cotula*. *Macrosiphoniella aktashica tapuskae* is widely distributed mostly in Palaearctic (from Europe to Asia) and known from many Anthemidae (*Achillea, Anacyclus, Anthemis, Argyranthemum, Artemisia, Chrysanthemum, Matricaria*, and *Tanacetum*). This species is monoecious holocyclic with alate males.

Distribution: Alaska, Colorado, Illinois, New York, North Carolina, Pennsylvania, Tennessee, Wisconsin.

Material examined: Paratypes. USA, **Illinois**, Harrisburg, 1 apt viv. fem., *Achillea* sp., 14.04.1930, leg. Frison & Ross, 010015590 (NHM), Anna, 2 apt. viv. fem., 19.04.1930, 010015595 (NHM). Other material: **New York**, Apalachin, 4 apt. viv. fem., *Anthemis cotula*, 05.08.1965, leg. L. Pechuman, 010015700 (NHM), 2 al. viv. fem., 21.08.1965, 010015705 (NHM), **Pennsylvania**, Phylipsburg (Black mosh Dam), 4 apt. viv. fem., *A. millefolium*, 17.08.1950, leg. Pepper, 010015704 (NHM), **Wisconsin**, Milwaukee, 1 apt. viv. fem., 2 al. viv. fem., *Achillea* sp., 24.06.1933, leg. Strom, 010015703 (NHM).

Remarks: Kadyrbekov (2019) reviewed the Palaearctic species and considered *M. tapuskae* to be a subspecies of *M. aktashica* (Nevsky 1928). In this work and due to stabile differences we upheld the full species status of this taxon.

Macrosiphoniela (*Phalangomyzus*) cf. *antennata* Holman & Szelegiewicz, 1978

Holman & Szelegiewicz 1978: 189

Figure 2g

Colour in life: Apterous viviparous females pinkish or bluish-pruinose with brown head and dark spot between siphunculi. Antennae, legs, SIPH and cauda dark brown to black. *Pigmentation on slide*: Apterous viviparous females with head sclerotized, brown and brown ANT with paler basal part of ANT III. Femora of legs brown with yellow proximal half of fore femora and only proximal bases of middle and hind femora. Tibiae uniformly brown. Abdomen with pale brown antesiphuncular sclerites, uniformly brown SIPH and cauda (Figure 2g).

Host plants and biology: Macrosiphoniella antennata lives on different species of *Artemisia*. In the USA it has been collected from a cultivated *Artemisia* resembling *A. filifolia*. The species lives singly or in small groups at the top of the shoots and on the underside of leaves (Blackman & Eastop 2020). They drop quickly to the ground when disturbed. So far no sexual morphs are known.

Remarks: Our specimens collected in California show some morphological differences to the type material from Mongolia. According to Blackman and Eastop (2020), until the morphological variation (in pigmentation and siphuncular length) has been studied further it seems best to apply the name "*antennata*" to all members of this group. We think that in this case we have not enough material to be analyzed and compared to describe a new species, which may done in the near future after a deeper examination of material from the USA, China, and elsewhere.

Distribution: California – first report in 2014 (Skvarla et al. 2017).

Material examined: Holotype. Mongolia, Ulan-Bator, apt. viv. fem., *Artemisia* sp., 30.07.1963, leg. H. Szelegiewicz, Szel. 185/apt.1; Paratypes. Mongolia, Ulan-Bator, 2 apt. viv. fem., *Artemisia* sp., 30.07.1963, leg. H. Szelegiewicz, 010014589 (NHM). Other material. USA, **California**, Yolo Co., Davis, 4 apt. viv. fem., 1 al. viv. fem., *Artemisia* cf. *filifolia*, 16.04.2014, leg. A. Jensen, AJ7000 (AJ), 2 apt. viv. fem., 2 al. viv. fem., AJ7001 (AJ).

Macrosiphoniela (*Phalangomyzus*) *grandicauda* Takahashi & Moritsu, 1963

Takahashi & Moritsu 1963: 9

Figures 2h and 4h

Colour in life: Apterous and alate viviparous females are pale yellow or pale green with mainly dark brown antennae and legs, black SIPH, cauda pale (Blackman & Eastop 2020).

Pigmentation on slide: Apterous viviparous females in general pale to yellow or light brown. Head slightly sclerotized, yellow, brown laterally between eyes and ANT tubercles. Antennae pale with light brown basal part and distal end of ANT III and distal ends of other segments. Femora pale to yellow with light brown band near the distal ends (so the very distal end of femora is paler). Tibiae pale to yellow with light brown distal parts except fore tibiae in which proximal parts are also darker. Abdomen pale without visible sclerotization, siphunculi yellow to light brown, pale basally, and cauda pale (Figure 2h). Alate viviparous females with head and thorax sclerotized light brown to brown. Antennae in general light brown with darker ANT III (but its basal part pale). Femora yellow basally, brown apically, fore and middle tibiae yellow, brown areas both basally and near apex, the extreme base paler, hind tibiae without the brown basal section. Abdomen pale without sclerotization, SIPH brown with pale basal part, cauda pale (Figure 4h).

Host plants and biology: This species feeds on species of *Artemisia* and is also recorded from *Ainsliaea aptera, Arctium lappa*, and *Petasites japonicas*. The aphids live on older leaves. No sexual morphs are known so far.

Distribution: Maryland – first record in 1997.

Material examined: USA, **Maryland**, Prince George's Co., Beltsville, 2 apt. viv. fem., *Artemisia vulgaris*, 28.10.1998, leg. A. Jensen, 010014692 (NHM), 2 apt. viv. fem., AJ1507 (AJ), 2 apt. viv. fem., AJ1508 (AJ); JAPAN, Sapporo, apt. viv. fem., *Artemisia* sp., 01.05.1965, leg. M. Miyazaki, 010014566 (NHM), KOREA, Kangnung, 3 al. viv. fem., 21–31.06.1967, leg. W. H. Paik, 010014569 (NHM).

Macrosiphoniela (*Phalangomyzus*) *oblonga* (Mordvilko 1901)

Siphonophora oblonga Mordvilko 1901: 341

Slender mugwort aphid

Figures 2i and 4i

Colour in life: Apterous viviparous females are pale green to apple-green. Head and thorax light green to grey-green, slightly wax-powdered with black ANT. Femora green with yellowish-green or brownish-green distal parts. Tibiae yellowish or brownish. Abdomen shiny green with paired greyish pleural patches of wax powder with brown SIPH with paler bases, and greenish cauda. Head, thorax, and abdomen of alate viviparous females shiny green with thorax sometimes slightly wax-powdered. Antennae black. Femora greenish with dark distal parts, tibiae brownish-green with darker distal parts. Siphunculi black with paler basal parts. Cauda greenish (Heie 1995).

Pigmentation on slide: Apterous viviparous females mostly yellow to pale brown. ANT brown except ANT III paler at base and in middle, ANT IV paler basally. Femora blotchy light brown, especially dorsally, tibiae brown apically. SIPH brown with paler bases, cauda light brown (Figure 2i). Alate viviparous females yellow with sclerotized head and light brown thorax. Antennae dark with ANT III paler basally. Femora yellow with dark bands near the distal parts, extreme apex yellow. Tibiae yellow with dark distal ends. Abdomen without visible sclerotization, SIPH brown, pale basally, cauda light brown (Figure 4i).

Host plants and biology: The species feeds on *Artemisia vulgaris* on which it usually can be found dispersed on undersides of lower leaves (occasionally on flower stems), also sometimes on other species of *Artemisia* and on cultivated *Chrysanthemum*. Oviparae and apterous males occur in late September and October (Heie 1995; Blackman & Eastop 2020).

Remarks: Robinson (1987) mentioned that this species was intercepted a number of times at U.S. ports of entry in the 1960s. He chose not to include *M. oblonga* in his key to species and seemed

to consider it unlikely that the species had established in the U.S. We cannot argue with this point of view but consider it worthwhile to include the species here in case it has, or will soon, be confirmed on this continent. Species that are frequently intercepted at ports of entry very often end up establishing. Aphids are collected by few specialists and it may take quite some time for newly established adventive species to be discovered and documented. There is a record given for this species from Alaska (The International Barcode of Life Consortium 2016) although after examination of the DNA sequence (GenBank BLAST) it matches with the sequences of two species (*M. oblonga* and *M. grandicauda*) and without access to the voucher specimen we are unable to judge about the species identity.

Material examined: DENMARK, Nødebo at Esrom, 1 apt. viv. fem., *Artemisia vulgaris*, 17.06.1972, leg. O. Heie, 010014855 (NHM); UK, Suffolk, Wargford Warren, 1 al. viv. fem., *Artemisia* sp., 12.07.1974, leg. J. H. Martin, 010014977 (NHM), 6 apt. viv. fem., 010014841 (NHM), London, Kew, 1 al. viv. fem., *A. vulgaris*, 28.06.1987, leg. AP, 010014892 (NHM).

Key to apterous viviparous females of *Macrosiphoniella* of USA

1. Abdomen with spino-pleural sclerotic cross-bars on ABD 1–5 … ..... ***M. absinthii***
- Abdomen without spino-pleural cross-bars **2**
2. Siphunculi at least pale basally contrasting to the dusky or dark rest of the length or distal part .. **3**
- Siphunculi uniformly dusky or dark **12**
3. Siphunculi length up to 0.40 mm **4**
- Siphunculi length more than 0.40 mm … **5**
4. URS/HT II 0.88–0.94. Cauda with 8–14 setae ..... ***M. frigidicola***
- URS/HT II 0.64–0.72. Cauda with 13–20 setae ..... ***M. abrotani***
5. Cauda dusky to dark in contrast to the pale part of the siphunculi ..... ***M. oblonga***
- Cauda as pale as the pale part of siphunculi **6**
6. Hind femora dark with only basal parts pale. Hind tibiae uniformly dark ..... ***M. pennsylvanicum***
- Hind femora pale with distal parts dusky to dark. Hind tibiae not uniformly dark 7
7. URS not stiletto-shaped, more rounded apically, with accessory and subapical primary setae similar in length ..... ***M. leucanthemi***
- URS stiletto-shaped and/or pointed apically with accessory setae longer than subapical primary setae **8**
8. Subapical zone of reticulation about 0.20–0.30 length of siphunculi which are slender, tapering and slightly curved ..... ***M. tapuskae***
- Subapical zone of reticulation more than 0.30 length ofsiphunculi which are tubular and straight **9**
9. Distal parts of femora mostly brown but with distinct paler band or blotches pre-apically ... **10**
- Distal ends of femora uniformly brown to dark or pale **11**
10. ANT III with 1–7 secondary rhinaria. ANT IV–V mostly pale with dark proximal and distal parts and ANT IV with one or two short darker areas associated with groups of setae ..... ***M. grandicauda***
- ANT III with 10–13 secondary rhinaria. ANT IV–V more or less uniformly dark, sometimes with basal part paler than apical half ..... ***M. cinerescens***
11. URS/HT II 0.82–0.92. Accessory setae on URS 0.09–0.10 mm long ..... ***M. ludovicianae***
- URS/HT II 1.35–1.50. Accessory setae on URS 0.025–0.030 mm long ... ***M. sunshine*** sp. nov.
12. ANT III with secondary rhinaria on the entire length ..... ***M. sanborni***
- ANT III with secondary rhinaria on at most 2/3 of the length (usually on ½) **13**
13. Hind tibiae with a ventral-medial row of short, thick, peg-like setae ..... ***M. millefolii***
- Hind tibiae with setae of various lengths, but without a row of peg-like setae **14**
14. Hind femora with basal ~½ pale or nearly so; tibiae entirely dark or nearly so ..... ***M. glabra***
- Hind femora dark except extreme base, or mostly brown with subapical pale spot **15**
15. Hind femora with pigmentation over most of length but with pre-apical pale spot ... ***M.* cf. *antennata***
- Hind femora uniformly dark beyond extreme base **16**
16. Tibiae with long pale middle section; dorsum of abdomen with spinal and pleural setae on more or less pale raised scleroites ... ***M. subterranea***
- Tibiae entirely dark or nearly so; abdominal setae not on raised scleroites **17**
17. ANT III almost entirely very dark, with about 20 secondary rhinaria ..... ***M. tanacetaria***
- ANT III with basal part pale, gradually darkening toward apex, with ~ 5–10 accessory setae ..... ***M. artemisiae***

Key to known alate viviparous females of *Macrosiphoniella* of USA

1. Abdomen with large cross-bars and sclerites from fused scleroites ..... ***M. absinthii***
- Abdomen without large cross-bars and sclerites fused from scleroites **2**
2. Siphunculi at least pale basally **3**
- Siphunculi entirely brown, dark or black **12**
3. Cauda as dark as the dark part of the siphunculi ..... ***M. oblonga***
- Cauda paler than the dark part of the siphunculi **4**
4. Siphunculi up to 0.40 mm long **5**
- Siphunculi more than 0.40 mm long **6**
5. ANT III with 21–35 secondary rhinaria ..... ***M. abrotani***
- ANT III with 14–17 secondary rhinaria ..... ***M. frigidicola***
6. Femora uniformly dark (or at least uniformly dark over distal half) ..... ***M. pennsylvanicum***
- Femora darker distally, only near apex 7
7. Cauda with 8–13 setae ..... ***M. leucanthemi***
- Cauda with more than 13 setae **8**
8. Siphunculi much longer than cauda, tapering from the base with subapical zone of reticulation up to 0.30 of their length ..... ***M. tapuskae***
- Siphunculi as long as cauda, with subapical zone of reticulation more than 0.30 of their length . **9**
9. ANT III with no more than 15 secondary rhinaria ..... ***M. grandicauda***
- ANT III with more than 20 secondary rhinaria **10** Abdomen without antesiphuncular sclerites. Cauda with an evident constriction near the middle. Tibiae uniformly brown ..... ***M. glabra***
10. ANT III with 37–44 secondary rhinaria. Cauda without constriction, ANT uniformly brown, ANT IV/ANT III 0.75–0.76 .. ***M. cinerescens***
- ANT III with (37)-44-62 secondary rhinaria. Cauda at least with a little constriction, ANT with ANT V and VI lighter than ANT III and IV, ANT IV/ANT III 0.78–1.00 ..... **11**
11. URS shorter than HT II ..... ***M. ludovicianae***
- URS longer than HT II ***M. sunshine*** sp. nov.
12. Tibiae with paler middle section **13**
- Tibiae uniformly brown to black **14**
13. ANT IV with secondary rhinaria. Abdomen with scleroites ..... ***M. sanborni***
- ANT IV without secondary rhinaria. Abdomen without scleroites ..... ***M. subterranea***
14. ANT III paler from the base to about 1/3 of the length, usually with lesss than 36 secondary rhinaria **15**
- ANT III uniformly dark to black, usually with more than 35 secondary rhinaria **16**
15. ANT III with 22–36 secondary rhinaria, SIPH as long as or shorter than cauda ***M. artemisiae***
- ANT III with no more than 15 secondary rhinaria, SIPH as long as or longer than cauda ..... ***M. glabra***
16. Abdomen with spinal and pleural scleroites. Antesiphuncular sclerites distinct, dark ..... ***M. millefolii***
- Abdomen without spinal and pleural scleroites. Antesiphuncular sclerites indistinct, pale ..... ***M. tanacetaria***

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Supplementary material

Supplemental data for this article can be accessed here.

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